Good Practices in Climate Action

A City Climate Alliance Partners' Initiative

In collaboration with CITIIS

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City Climate Alliance:

The City Climate Alliance is a coalition of partners committed to climate action. Based out of the National Institute of Urban Affairs (NIUA), India, the alliance is an aggregator for capturing climate actions, innovations and transitions. The coalition aims at building a partner community for climate action through knowledge sharing and exchanges on national and international platforms. The alliance also contributes to policy acceleration, creating repositories of climate action and supporting capacity building for just climate transitions.

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Foreword

Kunal Kumar

Joint Secretary, Ministry of Housing and Urban Affairs
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Vice President, National Institute of Urban Affairs

India will add over 300 million urban residents into cities upto 2050, bringing the urban population to over 850 million people. The country has also declared its ambition of becoming a 10 trillion-dollar economy by 2030. And most importantly, a commitment to achieve net zero by 2070 while achieving a balance between economic prosperity and climate security in these ever-growing cities.

The 'Good Practices in Climate Action' handbook comes in at a critical juncture when there is a growing demand for cities to adopt resilient climate actions to attract investments, and create a sustainable climate infrastructure. The onus lies on city managers to ensure that such transformations align with environmental standards and practices.

Cities must see and learn from a nexus- of collective action, immediate and impactful solutions and effective partnerships and cooperation to achieve inclusive prosperity.

This handbook is a go-to-document, a ready menu of city climate actions put together through a consultation process by the City Climate Alliance at the National Institute of Urban Affairs (NIUA), which is a coalition of partners working towards hand-holding and shaping climate action.

The good practices highlighted in this handbook are partner-driven and help explore the success stories of cities across India. The practices will help cities replicate cross-sectoral multi-faceted projects which are a step towards realising pro-growth climate-secure futures.

I would like to encourage all cities in India to reach out to the project partners and cities that appear in this compendium for exchanging ideas and taking forward the ideas and replicating them into climate action in their backyard.

Preface

Hitesh Vaidya

Director
National Institute of Urban Affairs

The time to take action on climate change is now. And it is the cities that are drivers of this combat. This handbook addresses the ***What, Why, Which, Where,*** *and primarily the* ***How*** *of climate actions for Indian cities.*

This handbook gives city managers insight into how they can approach climate action, apply a gender lens to their projects and borrow from a ready menu of good practices primarily from India. This guide provides a roadmap for cities to capitalise on existing opportunities and success stories, which are aided by new thinking, innovations and technological disruptions.

This guide will serve as one of the primary documents for cities to learn, replicate, and connect with case studies most relevant to its need in climate action.

By using this handbook, city managers and policymakers can:

- Understand the finer nuances of climate action – adaptation and mitigation
- The five identified themes under which climate action can be initiated
- Access a ready menu of good practices for climate action projects
- Get access to ready resources from climate alliance partners
- Using a gender lens when analysing, planning, and making decisions

Climate actions here are disaggregated into the five pre-determined themes of Urban Planning, Green Cover and Biodiversity, Energy and Green Buildings, Mobility and Air Quality, Water Management and Waste Management. This guide gives a snapshot of these five thematic areas, possible interventions, key challenges and a menu of case studies gathered from NIUA's climate alliance partners and knowledge resources.

A good practices menu of over 55 case studies forms the core of this booklet. Based across different regions of India and the world, these practices will provide the baseline for ideas and inventions for Indian cities which are sitting on the inflection point of climate transitions.

Gender mainstreaming is crucial to the success and for bringing in inclusiveness in climate action. A fairly new concept that is gaining ground in urban transformation policies, the guide explains the term, its entry points and some case studies to show how projects can be gender mainstreamed.

Contents

Good Practices

Urban Planning, Green Cover, and Biodiversity

Energy and Green Buildings

Mobility and Air Quality

Water Management

Waste Management

The Gender Lens

Abbreviations + Acronyms

AHU	Air Handling Units
AI	Artificial Intelligence
BEEP	Building Energy Efficiency Project
BPI	Building Performance Index
BRT	Bus Rapid Transport
C&D	Construction and Demolition
CaaS	Cooling-as-a-Service
CapEx	Capital Expenditure
CBD	Central Business District
CBI	City Biodiversity Index
CDMP	City Disaster Management Plan
CHW	Chilled Water
CMC	Comprehensive Operation and Maintenance
CNG	Compressed Natural Gas
CPTED	Crime Prevention Through Environmental Design
CRUT	Capital Region Urban Transport
CSES	Centre for Socio-Economic and Environmental Studies
CSR	Corporate Social Responsibility
CWIS	Citywise Inclusive Sanitation
DCS	District Cooling System
DEWATS	Decentralized Wastewater Treatment System
DGU	Double Glazing Units
DISCOMs	Distribution Companies
DPR	Detailed Project Report
ECBC	Energy Conservation Building Code
EPC	Engineering, Procurement and Construction Model
EPI	Environmental Performance Index
ETM	Electronic Ticketing Machine
ETRAM	ETM-based Tool for Route Analysis and Monitoring
EVs	Electric Vehicles
FFWS	Flood Forecasting and Early Warning System
GBV	Gender-based Violence
GCC	Gross Cost Contract
GEF	Global Environment Facility
GESI	Gender Equality and Social Inclusion
GHG	Greenhouse Gas
GIS	Geographic Information System
GPS	Global Positioning System
GUMP	Green Urban Mobility Partnership
GWP	Global Warming Potential
HAP	Heat Action Plan
HVAC	Heating Ventilation and Air Conditioning
ICT	Information and Communications Technology
IoT	Internet of Things
IPCC	Intergovernmental Panel on Climate Change
ITS	Intelligent Transport Systems
KPI	Key Performance Indicators
LBSAP	Local Biodiversity Strategy and Action Plan
LIG	Low-income Group
LPG	Liquefied Petroleum Gas
MPLADs	Members of Parliament Local Area Development Scheme
MRF	Material Recovery Facility
MRV	Monitoring Reporting and Verification
MSW	Municipal Solid Waste
NbS	Nature-based Solutions
NBSAP	National Biodiversity Strategies and Action Plan
NRM	Natural Resources Management
O&M	Operation and maintenence
ODP	Ozone Depletion Potential
OHOT	One Home One Toilet
OpEx	Operational Expenditure
OSS	On-Site Sanitation
PCC	Plastic Collection Centre
PET	Polyethylene Terephthalate
PHE	Plate Heat Exchanger
PLC	Programmable Logic Controllers
PPE	Personal Protective Equipment
PV	Photovoltaic
QCBS	Quality and Cost Based Selection
RAC	Refrigeration and Air Conditioning
RWA	Residents Welfare Association
SCADA	Supervisory Control and Data Acquisition
SEAC	Super Efficient Air Conditioners
STP	Sewage Treatment Plant
SWAT	Soil and Water Assessment Tool
SWM	Solid Waste Management
SWMM	Storm Water Management Model
TES	Thermal Energy Storage
UCRA	Urban Community Resilience Assessment
UDT	Urban Design Thinking
VAM	Vapour Absorption Machine
VRV	Variable Refrigerant Volume

How to use this handbook?

This handbook advocates an overall approach for effective climate intervention and provides a menu card of proven good practices in climate action for cities, gathered through partner deliberations and crowd sourcing from partners. These are split under the five thematic areas of Urban Planning, Green Cover, and Biodiversity; Energy and Green Building; Mobility and Air Quality; Water Management; Waste Management. These cases can help cities find an approach best suited to their unique contexts.

Going ahead, the book also introduces a chapter on gender mainstreaming within projects with supporting case studies and entry points that could be used to demonstrate the effectiveness of the strategies outlined. This could help shape how the gender lens could be applied to the intended climate actions.

Designed to cater to city managers and policymakers, the handbook intends to stimulate and promote further thought and discussion but, above all, to formulate projects that stimulate climate action. The idea is to be able to pick up bits and pieces, or even entire projects, and replicate them through contextualisation and drawing local strategies.

To make the process easy, we have colour-coded themes and even put QR codes on each project page if a need arises to read the project in detail or connect with relevant partners.

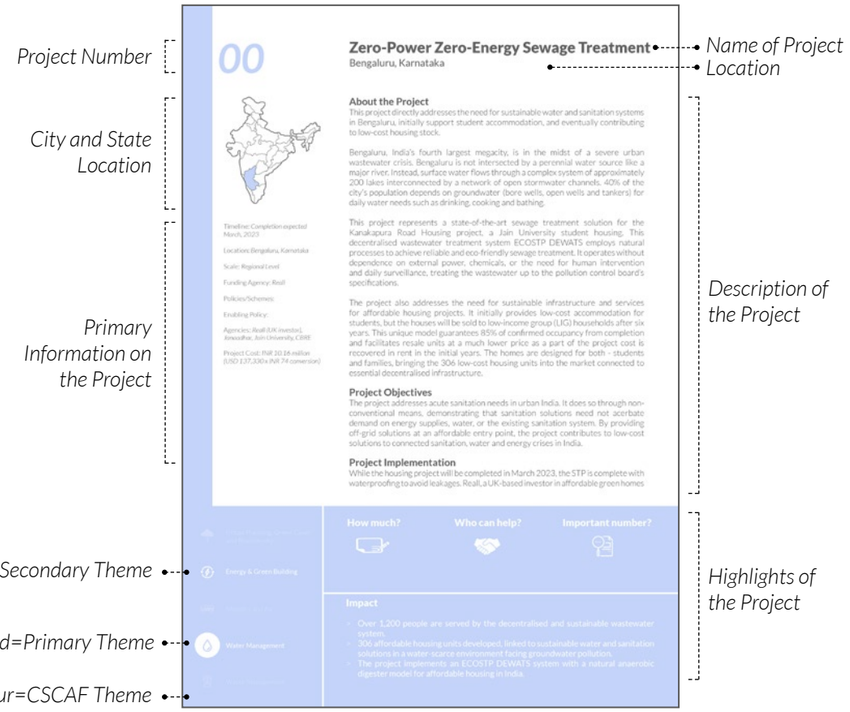
Chapter outline:

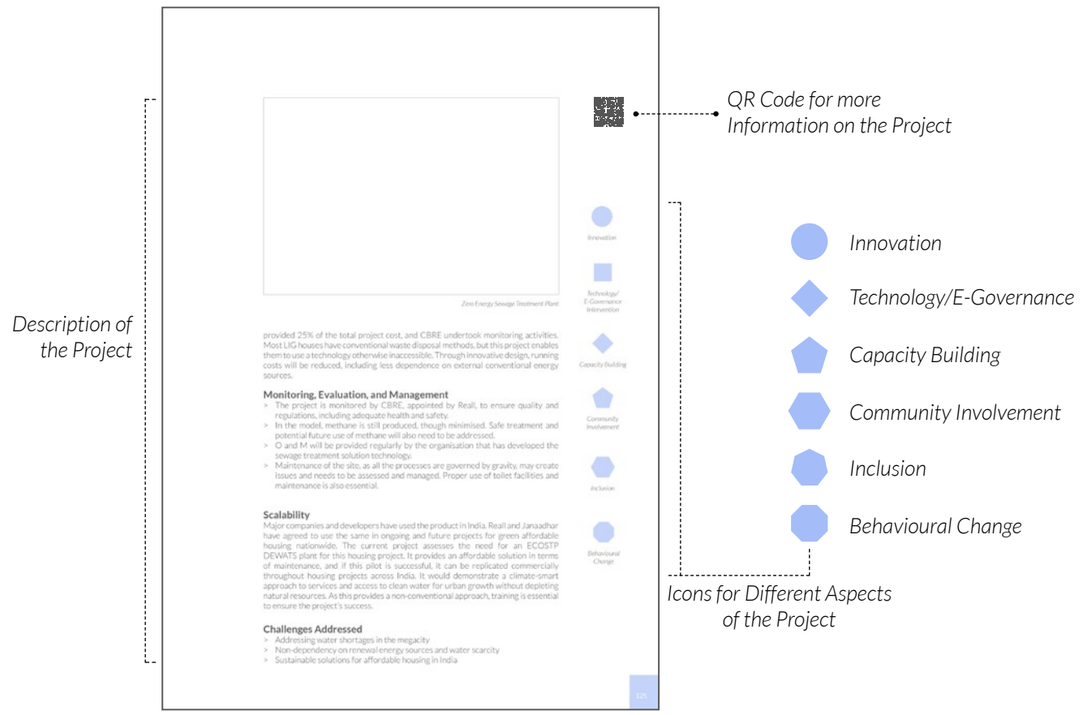
Colours for the thematic areas:

- Urban Planning, Green Cover, and Biodiversity
- Energy and Green Building
- Mobility and Air Quality
- Water Management
- Waste Management

All foreign currency is converted by an average rate for that decade.
Example: US Dollar converted at a rate of INR 62 for decade 2010 to 2019.

How to read the Good Practices spreads?





05

Partner Consultations

“Co-creation and collaboration – the two important pillars on which the partner’s consultations are based- are essential to healthy participatory governance processes.
This becomes even more critical when we are talking of climate action in cities where our partners work on ground zero and are able to relay and share the projects they are involved in, and the learnings that emerge from them, the challenges cities face.”

Lal Chhandama
Director SC-I (Smart Cities)
Ministry of Housing and Urban Affairs

For developing and crowd sourcing good practices for the handbook, the City Climate Alliance in collaboration with CITIIS 2.0 at the Climate Centre for Cities, National Institute of Urban Affairs (NIUA) had organised a three day, five session consultation from August three to five, 2022.

Based on the larger theme of climate action in cities, the consultation brought together alliance partners and subject experts from over 45 partner organisations to share their knowledge and experience in furthering climate action.

While the deliberations were thematic (and we have included specific learnings in the respective sections), there were some generic points that were echoed across the themes and are compiled below.

- Certain methodologies and the right quantification need to be identified before getting into a project. This should take into account available checklists and design thinking methods available with organisations, and apply them to city needs. Innovation comes much later at the maturation stages.
- While localisation and contextualisation of projects is the key, it is important that cities look at both national and international examples which are of globally accepted standards for replication. This is true for cities that lie in similar climatic zones or share similar demography and challenges.
- When a project is selected, even if the project covers a small portion of the city, it is important to integrate it into the larger context of the city. This ensures that the projects do not end up becoming an act of tokenism or pilots but get enmeshed within the city fabric and cater to its growth. This way, cities start looking at the project holistically. There was also a suggestion for integration into the larger state plans for development.
- Many projects and solutions proposed within them could emerge from the climate action plans or even from master plans which have certain climate components. These plans take a long-term view of 10 to 20 years, and therefore a project that emerges from these plans will propose actions which are critical for maintaining and preserving the ecosystems.
- The lack of appropriate and adequate data and outdated maps is a major issue that exists across cities, mostly Tier II and III, which impacts project proposals. This could be fixed by identifying local-level specific capacity building that could bridge this critical gap.
- There was a suggestion to benefit from the Climate Alliance with its partners as a help desk platform that could help handhold cities in formulating projects.

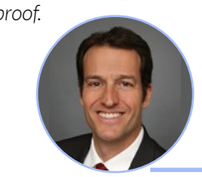
While these pointers are limited and not exhaustive in nature, the guidance and good practices that were shared give out a specific message - of co-creation, collaboration and embracing an ecosystem approach while charting and selecting projects for creating purposeful and proven climate action.

Partner Consultations

"CITIIS 2.0 is the next level of engagement from AFD towards building more resilient cities aiming to prepare climate-oriented urban development projects. We look forward to supporting innovative and participative proposals that can inspire urbanisation in India and beyond. As a development agency, we believe in peer-to-peer exchanges, and therefore, this particular compendium of case studies is an important tool for cities, which would help them design concrete climate-oriented projects in the future."

Bruno Bosle
Country Director-India
French Development Agency (AFD)

"The compendium is an excellent initiative, which will provide cities with example-cases on mainstreaming climate resilience aspects into programme design. This compendium contains a mix of initiatives which cities could adapt from, at various levels, and build on to arrive at the most suitable climate-resilient urban infrastructure interventions. While the topic is still at a nascent stage and ever evolving, all stakeholders have the collective vision of mainstreaming climate resilience in the urban context and making Indian cities climate-proof."



Philipp Wyrsch
Head of Urban Development and Mobility
KfW – New Delhi

"The CITIIS program has always encouraged the SPVs to conceptualise contextual and innovative urban solutions and hone them by collaborating with stakeholders, learning from their peers, and adapting global best practices. Going forward, CITIIS will direct its efforts towards supporting the localisation of climate action and creating an enabling framework for it, predominantly through financial and technical assistance. The 75 case studies in this book showcase some remarkable work done under the five thematic areas as defined under the National Mission for Sustainable Habitat and subsequently the ClimateSmart Cities Assessment Framework, which can guide cities to plan and propose projects that will stand the tests of time and climate change."

Naim Keruwala
Program Director
NIUA

"On the issue of expertise in climate (action), it is still a new subject and certain things are still not really there in the country. And cities will not demand it. Also, we have the luxury of having all climatic zones. So, you really can pick up from international mentorship with experience from anywhere and then tailor it to suit the Indian side."

Vaishali Nandan
Head of Projects
GIZ, India

Urban Planning, Green Cover, and Biodiversity

Ashu Dehadani, GBCI and Monalisa Sen, ICLEI in a conversation at the Partners Consultation.

Consultation for the theme - Urban Planning, Green Cover, and Biodiversity.

Saurav Chowdhury, Climate Group and Uttra Dasgupta, NIUA in a discussion.

Philipp Wyrsch, KfW; Sayli Mankikar, Hitesh Vaidya, and Naim Keruwala, NIUA.

Energy and Green Cover

Partner discussion for the theme - Energy and Green Buildings.

Sayli Mankikar, NIUA; Bhaskar Padigala, ICLEI; and Hitesh Vaidya, NIUA in a discussion.

Manjeet Singh, UNEP talked about their completed projects and the difficulties faced.

Naim Keruwala, NIUA and Benjamin Hickman, UNEP in a conversation at tea time.

(Climate) Mitigation is not only in the air quality space, it is in other spaces (as well). Air quality mitigation goes into mobility goes into waste management, but nobody's really looking at the correlations.

Prarthana Borah
Director
CDP

I think it has been like a great workshop - the partner consultation. And I think, also we learned a great extent on success of CITIIS 1.0. And I think as a whole, the programme (and) some of the themes are very interesting.

Manjeet Singh
Technical Advisor
UNEP

Gender is water. It needs to be a very clear component which should be integrated throughout the process and not just as a standalone thing that for gender we will do this much, that's not the idea of integrating gender.

Bedoshruti Sadhukhan
Senior Programme Coordinator
ICLEI South Asia

The Climate Alliance is a great opportunity where the cities and the various partners are collaborating. And it's a big opportunity for cross-learning across various cross thematic areas, and learning the best practices from each other, city to city, and partner(s) to cities. And I think the entire concept will eventually encourage city(ies) to come up with more and more innovations, ... a higher level of scalability and replicability across the country.

Laghu Parashar
Senior Advisor
GIZ, India

Mobility and Air Quality

Partners present under the theme - Mobility and Air Quality.

Vaishali Singh, ITDP and Sayli Mankikar, NIUA in a conversation

Prarthana Borah, CDP in a discussion on the theme - Mobility and Air Quality.

Prerna Vijaykumar Mehta, WRI; Roshan Toshniwal, OLA Mobility; and Laghu Parashar, GIZ

Water Management

Partners in an engaging discussion on Water Management.

Partners present at the City Climate Alliance Partners Consultation.

Partners in an engaging discussion on issues faced on ground.

Shriman Narayan, GIZ; Monika Bahl, GIZ; and Nitin Bassi, CEEW.

"This seems to be (a) very promising initiative, ...the kind of experience I've had working globally with cities, I'm sure this will bridge a lot of gaps and address a lot of challenges which cities are facing, because understanding climate resilience or any other race to de-carbonisation, ... it may make the city a bit lost. And the(se) kind of case studies... would be a helpful resource for cities to select and choose and decide the initiative and implement it."

Ashu Dehadani
Associate Director
GBCI

"From the perspective of a financing organisations, I think we feel that the urban climate resilience and adaptation is a very important topic. Initiatives such as the City Climate Alliance, and programs, such as CITIIS are very important milestones, both for the government of India as well as development banks."

Rahul Mankotia
Sector Specialist – Sustainable Urban Development
KfW

"More than half of road accidents involve vulnerable road users --- pedestrians and cyclists, so it is critical to address this issue. For cities to incorporate this efficiently, it is important that we start talking about striking a balance when it comes to alternative mobility solutions. Such solutions should focus on how cities can reflect this in development practices that facilitate inclusive and realistic space allocation for all users."

Prerna Vijaykumar Mehta
Associate Director
WRI India

"Urban mobility, especially the de-carbonisation of urban mobility remain(s) one of the major challenges for(the) city. Since most of our developing cities are facing the problem of mobility as well as air pollution, that is where the technical knowledge of (a City Climate) Alliance member will be very useful for (the) city to channelise their actions towards more result-oriented actions."

Vijay Saini
Manager
ICLEI South Asia

Waste Management

Partners in an engaging discussion on issues faced on ground.

Partners present at the City Climate Alliance Partners Consultation for Waste Management.

Sakshi Chadha Dasgupta, SDC (centre); Mahreen Matto and Rajiv Ranjan Mishra, NIUA

Partners online discuss under the theme - Waste Management.

"One very important component we have to consider in climate projects is the user. We have to join these dots and create a system in such a way that future replication will largely depend on the end user and what the need is. Then the success rate will be quite different."

Shabnam Bassi
Associate Director
GRIHA Council

"We are one of the proud partner(s) for City (Climate) Alliance. I'm sure we can do a lot of things together and I see cities in the region can benefit from these huge ... opportunities and resources available in this handbook."

Keshav Jha
Senior Project Officer
ICLEI South Asia

Climate Action: *A Thematic Approach*

The next five sections will give you a bird's-eye view of the five themes of the Climate Smart Cities Assessment Framework (CSCAF) derived by the Climate Centre for Cities of the National Institute of Urban Affairs (NIUA), which is the basis on which the good practices have been segregated. The sections simplify the concepts, provide the indicators, the insights gained from the partners in the City Climate Alliance Consultation and list projects that are a part of the menu in the handbook under the respective themes.

01

Urban Planning, Green Cover, and Biodiversity

With 4000+ urban centres, fast growing Indian cities are facing immense urban planning challenges. Climate change impacts and the increasing number of extreme weather events pose additional risks to critical infrastructure and aggravate the vulnerability of residents.

Water bodies and green spaces not only provide a better living environment but also help people to adapt to the adverse impacts of extreme climate events. Green areas also aid in carbon sequestration and minimising the impacts of air pollution.

SDG 11 (Sustainable Cities and Communities) and SDG 15 (Life on Land) outline the need to halt biodiversity loss. Water bodies and green spaces, which are part of urban planning not only provide a better living environment but also help people to adapt to the adverse impacts of extreme climate events.

Good Practices

**Thematic information has been extracted from Cities Readiness Report, 2021.*

Broad constituents and indicators in this thematic area*:

1. Rejuvenation and Conservation of Water Bodies and Open Spaces
Incorporating nature-based solutions and conservation of natural systems like the water bodies, green cover, open spaces and biodiversity in the city for climate mitigation and adaptation is an important part of mainstreaming climate action. Integrating and mainstreaming climate actions in the master plans, infrastructure development planning rules and city budgets, implementation of projects and functioning, institutional setting in monitoring and review mechanisms are a few interventions.

2. The Proportion of Green Cover
Conserving, rejuvenating and increasing green and blue cover in a city can play a critical role in terms of climate mitigation and adaptation. These measures help in decreasing local temperature, aid carbon sequestration, provide protection in case of floods, help recharge groundwater and minimise the impacts of air pollution.

3. Urban Biodiversity
Urban biodiversity provides significant ecosystem services and any imbalance poses major challenges to sustainable development and affects the lives and livelihoods of residents. Extreme weather events due to climate change have grave impacts on urban biodiversity causing loss of habitats.

4. Disaster Resilience
This includes developing city-level strategies, institutional and governance mechanisms for disaster risk reduction. There needs to be focused local action to mitigate the impacts of extreme events on communities and infrastructure.

5. City Climate Action Plan
This encompasses applying a climate lens to urban development plans, infrastructure investments and projects; and mainstreaming climate resilience in development codes, regulations and by-laws as key steps in the process.

Challenges highlighted at the City Climate Alliance Partners Consultation:

Accessibility to green and open spaces is a critical factor. This became a bone of contention, especially during the COVID-19 viral outbreak. Free and unrestricted access to all, open spaces for communities must be accounted for.

Green cover assessment must include the qualitative aspect and the challenge is to understand that not every small green patch can be considered green covered. An Ecosystem Assessment becomes crucial here and a granular overview must be considered while assessing green covers.

Any ecosystem-based adaptation method, or rejuvenation of any green space, or water body restoration, needs to be considered from the design stage itself. These should be part of development rules and feasibility studies.

The city climate plans should be part of statutory frameworks and inform master plans eventually. This will ensure it goes through mandatory processes of public consultation.

Updating data and ensuring that projects are based on fresh data is crucial. Capacity building for GIS mapping and remote sensing has to be initiated for cartographers who create spatial maps manually in a few cities. This will ensure the creation of robust digitised mapping of cities.

Measures projects could consider to aid their climate interventions*:

Strengthening institutional coordination and management through establishing dedicated city-level specialised committees such as Biodiversity Management Committees, City Climate Cells and Environmental Committees, and City Disaster Management Cells.

Local level strategies to be aligned with national and state level plans like the National and State Action Plans for Climate Change (NAPCC and SAPCC), National Clean Air Plan (NCAP), National and State Biodiversity Guidelines (Biological Diversity Act, 2002) and the State/District Disaster Management Plans. Streamlining these plans into departmental plans, city master plans and infrastructure DPRs may be ensured for holistic sustainable development in cities.

Data-informed decision-making is crucial for assessing gaps and guiding policymaking. Cities are recommended to prepare and update GIS maps for attributes like water bodies and open spaces coverage, encroachments, urban heat island, disaster-specific risks and vulnerabilities, tree type and biodiversity, etc.

Important statistics:

- The World Health Organisation (WHO) prescribes 9 sq. m of green space per capita in urban areas. Chennai has only 0.81 sq. m per capita and Pune has 1.4 sq. m per capita of green cover
- As of 2017, India's per capita emissions are much lower - less than half - as compared to the global average. However, more than 70 percent of our emissions are coming from urban areas

**Thematic information has been extracted from Cities Readiness Report, 2021.*

Photo Credit: National Institute of Urban Affairs, Delhi

02

Energy and Green Buildings

The growing urban population contributes to an increase in energy consumption. Currently, much of the energy consumed is derived from burning fossil fuels, thereby contributing to Green House Gas (GHG) emissions. This thematic area is focused on measures taken to reduce energy consumption, increase energy use efficiency and transition to clean energy (renewables). The promotion and adoption of green buildings are also important to address the fallouts of the built environment, which are prime contributors to GHG emissions.

Energy and Green Buildings

**Thematic information has been extracted from Cities Readiness Report, 2021.*

Broad constituents and indicators in this thematic area*:

1. Control of Electricity Consumption
The generation of electricity primarily depends on fossil fuels, leading to higher GHG emissions. Controlling and reducing the per capita electricity consumption will lead to lower GHG emissions. To enable this, cities will need to understand the energy consumption pattern and adopt relevant energy-efficient measures to lower per capita electricity consumption.

2. Increase in energy from Renewable Sources
Cities can leverage government schemes and initiatives like the Rooftop Solar programme, Solar Net Metering and Grid Connected Wind-Solar Hybrid Power Projects, availing existing concessions in transmission and enhancing the use of renewable energy.

3. Reduction of Fossil Fuel Consumption in the City
There is a need to switch to safe, smart, and sustainable energy consumption as key means of limiting greenhouse gas emissions in India. Cities should be encouraged to switch to alternative cleaner fuel sources and to lower the per capita emissions from the consumption of fossil fuels by shifting to lower-emitting fossil fuels and non-fossil fuel-based sources.

4. Energy Efficient Street Lighting in the City
Street lighting is a major contributor to the city's electricity consumption. Energy efficient and renewable energy operated street lighting systems will reduce the dependence on electricity from fossil fuels, thus indirectly reducing GHG emissions in the city. Energy-efficient street lights should have lamps with luminous efficacy of more than 85 lumen per watt. LED and renewable energy-operated street lights have successfully improved the energy efficiency of municipal services in cities across India.

5. Promotion of Green Buildings
Together, buildings and the construction industry account for 36 percent of global energy use and 39 percent of energy-related CO2 emissions annually. Green buildings provide some of the most effective means of achieving a range of global goals, such as addressing climate change, economic growth and social aspects. This is met through compliance procedures, penalty/ reward schemes, and stakeholder cooperation for the promotion of new and existing green and construction of energy-efficient buildings.

6. Green Building Adoption
The energy use from buildings is increasing at eight percent annually and, in a business-as-usual scenario, buildings would account for over 70 percent of emissions by 2050. The growth of the buildings sector and its contribution to climate change plays a critical role in India's actions towards addressing climate risks and achieving sustainable development goals.

Challenges highlighted at the City Climate Alliance Partners Consultation:

The issue of jurisdiction becomes crucial as cities do not have too much say in distribution and transmission of electricity, and so the success of the project hinges on the involvement of state governments and electric companies in projects.

An important component of projects which gets sidelined is the user. Projects should include roadmaps that account for the user, their training and inclusion at every step of a project to do with energy saving and efficiency.

Measures projects could consider to aid their climate interventions*:

Leverage government schemes and initiatives like the Rooftop Solar programme, Solar Net Metering and Grid Connected Wind-Solar Hybrid Power Projects for adopting renewable energy at the city level.

Cities may set up monitoring and evaluation cells for facilitating energy-efficient projects and conducting audits.

Cities can integrate an Energy Monitoring Information System (EMIS) integrated with the Integrated Command and Control Centres (CCCs) to monitor sector-wise energy usage. Smart automation through GIS-based monitoring integrated with the ICCCs can also bring in further efficiency to street light management.

For promoting green building practices, cities are suggested to adopt the National Building Codes, 2016 or Energy Conservation Building Code, 2017 or Eco-Niwas Samhita, 2018 in their building rules and laws.

City-level green building cells may be established to ensure compliance with the regulations, initiate green building certifications for institutional and commercial buildings and promote incentives like additional FARs and property tax rebates to enhance the adoption of green buildings in the city.

Important statistics:

- India is already working towards achieving a 175 GW of renewable energy target by 2022, which includes 100 GW of solar (JNNSM) and 60 GW of wind
- Urban India is expected to build 700 million to 900 million sq.m of residential and commercial spaces, 350 to 400 km of metros and subways, and 19,000 to 25,000 km of road lanes annually

**Thematic information has been extracted from Cities Readiness Report, 2021.*

Photo Credit: National Institute of Urban Affairs, Delhi

03

Mobility and Air Quality

Vehicles plying within cities usually contribute to a significant portion of GHG emissions and also cause a reduction in air quality. Cities are encouraged to provide adequate and accessible public transportation and non-motorised transport infrastructure along with initiatives undertaken for transitioning to low carbon mobility. While these measures support in mitigating future GHG emissions, cities also need to address the challenges of air pollution.

Increasing CO2 deteriorates the air quality and cities are beginning to experience its adverse impact, especially on human health. Focus on sustainable urban mobility can help address not only transport-related challenges but also mitigate climate change and improve air quality paving the way for resilient cities.

Mobility and Air Quality

**Thematic information has been extracted from Cities Readiness Report, 2021.*

Broad constituents and indicators in this thematic area*:

1. Clean Technologies Shared Vehicles
With many cities still working on providing public transport options like buses and metros, shared vehicles like app-based taxis and autos have emerged as an alternative mode. The ease and comfort of availing of these services are contributing to a modal shift, especially among private car owners. If this is done in coherence with switching to low-carbon fuels like electricity and CNG, it will be significantly successful in reducing GHG emissions in the transport sector.

2. Availability of Public Transport
Many city governments have been driving the provision of bus and rail-based mass transit systems through organized and well-planned models. Increasing the fleet size of public transportation by exploring PPP models, route rationalization, reworking schedules and last mile connectivity are a few ways of improving public transport.

3. Percentage of Coverage of Non-Motorized Transport Network (pedestrian and bicycle)
NMT is a highly cost-effective transportation strategy and brings about large health, economic and social co-benefits. Keeping in mind these complexities, a more people-centric and innovative approach is needed for NMT development and promotion. Cities can promote NMT modes by developing a safe environment for cycle lanes and footpaths. Better regulations for signages and safe crossroad islands can be incorporated.

4. Air Pollution/Clean Air (Monitoring, Planning and Implementation)
Monitoring data on air quality and making it available to the public will help in framing policies and also allow citizens to make informed decisions that can improve the quality of their lives. The current urbanisation is fuelling climate change and the deprivation of air quality. There needs to be an urgent shift towards interventions to improve indoor and outdoor air quality.

Challenges highlighted at the City Climate Alliance Partners Consultation:

Various agencies involved in the urban transport sector need to be brought under a single ambit for increased efficiency and accountability.

Dynamic data collection through urban analytics and transport modelling, improving public transport infrastructure and last mile connectivity will be required.

The urban transportation and mobility sector is a very male-dominated domain and therefore projects need to be gender inclusive to ensure policies have a gender lens. It was suggested that there should also be the inclusion of people with special needs and disabilities.

More digital tools need to be brought in and improvisation of the existing services needs to be considered for mobility.

There is a scope for improvement in passenger information system data analytics and usage. The data must be used by city governments for better mobility-related decision-making.

Measures projects could consider to aid their climate interventions*:

Low carbon public transport is essential for reducing GHG emissions and improving air quality which can be done through improved efficiency, route rationalization, schedules and last mile connectivity to attract people to shift to public transport.

Cities can conduct public transport demand assessments and explore PPP models for increasing the fleet size of buses. By adopting national schemes and guidelines on shared mobility for procuring low-carbon vehicles (like e-rickshaws and e-taxis) cities can procure low-carbon vehicles and develop the desired infrastructure to enable low-carbon mobility transition.

Various projects on public bicycle sharing and awareness campaigns have been initiated to improve NMT infrastructure. Steps can be initiated by cities to increase the NMT coverage for cycle lanes and footpaths to over 35 percent, especially in high-traffic clusters and high-use networks through dedicated planning and budget allocation.

Cities are recommended to install continuous air quality monitoring sensors and make the dynamic data available to the public through display boards and public applications.

Cities are encouraged to develop city clean air action plans aligning with the National Clean Air Plan (NCAP) leading to improving air quality and achieving the national air quality standards.

Important statistics:

- The growth in ownership of motor vehicles per 1,000 population has increased from 53 in 2001 to 167 in 2015
- The annual growth rate of motor vehicle numbers in India has been about 10 percent during the last decade, of which 32 percent of these vehicles are plying in metropolitan cities
- Air pollution is one of the world's largest health and environmental problems, attributed to five million deaths each year, with nine percent being globally

**Thematic information has been extracted from Cities Readiness Report, 2021.*

Photo Credit: National Institute of Urban Affairs, Delhi

04

Water Management

In India, more than 40 percent of the annual surface water is consumed. The growing demand for water from industries leads to further depletion of groundwater resources. Most cities are unable to tackle the two-fold challenges of the increasing demand for potable water during summer and the management of excess water during extreme precipitation events. This is mainly due to ageing infrastructure, inadequate monitoring, improper management and lack of holistic planning. Various measures such as recycling, reusing water and reducing transmission loss, will need to be put in place to save water.

Water Management

**Thematic information has been extracted from Cities Readiness Report, 2021.*

Broad constituents and indicators in this thematic area*:

1. Water Resources Management
While setting the path towards improved water resources management, cities face various challenges. This is primarily related to poor planning and implementation owing to institutional overlaps and lack of manpower. Further, gaps in local capacity management are a challenge in formulating and implementing strategies. Cities can improve water systems through groundwater management to mitigate water stress and develop water resources management with short, medium and long-term actions.

2. Extent of Non-Revenue Water
Non-revenue water comprises the consumption of authorised but non-billed water and systemic water losses. The non-billed part comes from public stand posts; illegal water connections, water thefts and metering inaccuracies. Real losses account for leakages in the transmission and distribution networks that take place due to broken or corroded pipes.

3. Waste Water Recycle and Reuse
Recycling and reuse of wastewater are critical for water conservation. This becomes grave in areas with decreasing freshwater availability and increasing costs for delivering safe water, often from a far distance. Adopting recycling and reusing water for non-potable domestic use, in horticulture and agriculture, power plants, and industrial use can reduce water pollution and the stress on water availability.

4. Flood/Water Stagnation Risk Management
With growing cities and increasing floods, the need for creating city-level flood management plans in alignment with the district disaster management plans is critical. Conducting flood assessments, identifying vulnerable hotspots, and establishing Early Warning Systems (EWS) and flood management protocols are essential for the cities that experience flooding and water stagnation.

5. Energy Efficient Water Supply Systems
Setting up an energy-efficient water supply system is significant for reducing energy consumption and indirectly mitigating GHGs emissions. Such a system focuses on bringing energy efficiency to the water supply with a twofold benefit of reducing municipal expenditure and energy demand.

6. Energy Efficient Wastewater Management System
Around 10 percent of the wastewater generated in India is estimated to be treated using old pumping and electro-mechanical equipment that consumes a high amount of energy. Focusing on energy efficiency wastewater management is key to reducing energy demand and municipal expenditure. Reduced energy demand provides a co-benefit in mitigating GHGs emissions.

Challenges highlighted at the City Climate Alliance Partners Consultation:

Projects in the water sector need an integrated approach that is cross-sectoral in nature, with multiple feedback loops during planning, project development, implementation and operations.

Scientific knowledge and on-ground research should become an essential component of decision-making in planning projects related to water, as each aspect of this sector are extensively dependent on the variability across geographies, climate zones, and time.

The five-step philosophy suggested for undertaking research in water management is key to identifying contextual water management issues. This includes:

- Seasonality, water quality etc.
- Key climate challenges and risks like floods, droughts etc.
- Water balance
- Supply-side interventions and management - technical and institutional interventions, treatment capacity, reuse of water, policy changes and action
- Coordination and collaboration across various departments, organisations, and communities involved

Gender should be mainstreamed and integrated throughout the project and not be considered a stand-alone aspect in water management processes.

There is a negative narrative associated with rainwater and stormwater considering it is drained out as soon as it is collected. The potential of treated rainwater and stormwater as sources of clean water is not tapped enough and can used to tackle the water crisis in the country.

Measures projects could consider to aid their climate interventions*:

Cities can initiate a study which maps ground and surface water to assess the status of existing water resources. A water resource management committee can be put in place to guide cities in developing city/ catchment-wide water management plans.

Preparing a misplaced capital water study or conducting a water audit to understand the real losses, apparent losses and unbilled authorised consumption is recommended. Post the assessment, cities could monitor the leakages and water losses in the existing water supply system and focus on reducing them.

Cities can explore sustainable measures for recycling wastewater, such as biogas, biofiltration, combined heat and power (CHP) technology, decentralised wastewater system, etc.

Important statistics:

- In India, 32 percent of urban households have piped sewer systems, and only 10 percent of the overall sewage generated is treated
- The National Urban Sanitation Policy, 2008, has prescribed a minimum of 20 percent wastewater reuse for cities
- Cities in India spend around 30 to 40 percent of their annual expenditure towards energy for pumping, storing, transporting and distributing water
- Annually around 7.5 million ha of land is impacted by floods resulting in the loss of more than 1,600 lives and damages to houses and public utilities exceeding over INR 18 billion

**Thematic information has been extracted from Cities Readiness Report, 2021.*

Photo Credit: Ashishkrishna H

05

Waste Management

Waste management is one of the significant environmental concerns considering the imbalance between waste generation in cities and its disposal capacities. This is because of several reasons including inadequate landfill areas, few waste disposal mechanisms, and in some cases lack of precautions and operational controls on disposal. Hence, government projects and policies at the national, state, and local levels are required to minimise, manage and recycle waste.

Waste Management

**Thematic information has been extracted from Cities Readiness Report, 2021.*

Broad constituents and indicators in this thematic area*:

1. Waste Minimisation
The current practice of waste management in India include open dumping leading to various problems such as contamination, lack of scientific treatment, inadequate waste collection and increased generation of plastic waste. Many cities are innovating and undertaking initiatives to reduce dry/ wet waste including treatment of domestic hazard waste, on-site waste processing by non-bulk waste generators, using bulk waste generators to treat dry and process wet wastes and processing of wet waste at household/ community level.

2. Extent of Dry Waste Recovered and Recycled
Segregation, recycling and reusing waste can be viable and cost-effective solutions to reduce waste. Recycling mainly involves recovering and reprocessing usable materials (predominantly dry waste) that generally might end up as waste, such as plastic, paper, etc.

3. Construction and Demolition (C&D) Waste Management
Construction and Demolition (C&D) waste management impacts water bodies, green areas and public spaces in Indian cities that witness unsafe construction disposal of concrete, bricks, and metal waste. Residents in fast growing urban agglomerates are at the receiving end of toxic dust particles from the debris further impact the air quality and increasing pollutants.

4. Extent of Wet Waste Processed
Management of organic wet waste is essential as it will substantially reduce the pollution volume induced by improper waste management. To mitigate climate change and improve the quality of life, cities need to manage wet waste by setting up appropriate processing facilities and scientifically operated systems.

5. Scientific Landfill Availability and Operations
In India, landfills pose numerous threats due to their unscientific design and indiscriminate waste disposal. One of the critical threats is the emission of methane gas due to the accumulation of waste, causing fires at landfills and resulting in garbage burning, which causes severe air pollution. Landfills also pose tremendous health hazards as they are a storehouse of viruses and bacteria, causing cardiovascular and lung diseases. With nearly 72 percent of India's garbage remaining untreated, scientific landfills are an option for urban India to ensure proper waste management.

Challenges highlighted at the City Climate Alliance Partners Consultation:

Interlinking themes and working on projects through a cross-sectoral approach can help develop holistic projects. This method can help integrate ideas around gender inclusivity as a part of the process rather than an isolated decision.

Waste management and sanitation operations and management should ensure the participation, respect and inclusion of the communities involved.

Cities should evaluate projects and programmes in waste management with the life cycle cost of a project rather than the net present value for sustainable long-term solutions.

Implementation frameworks should be available in local languages for the involvement of the community, local officials, media, vernacular experts, and the private sector.

Measures projects could consider to aid their climate interventions*:

Monitor all the Bulk Waste Generators (BWGs) within their purview monthly and ensure the segregated wet waste, including kitchen/ garden waste, is being processed on-site or collected and processed by private parties authorised by ULB.

Focus on promoting source segregation of dry waste through various awareness programs and rigorous campaigning to achieve 100 percent recycling and reuse of waste.

Maintain proper baseline data for assessing the quantity of waste recycled annually.

Prioritise setting up C&D Waste management systems and maintain the inventories of construction activities in the city. To begin with, cities can notify dumping points and storage facilities for C&D waste.

Cities can treat their wet waste effectively by segregating and processing it through decentralised approaches such as composting and community-level bio-methanation plants.

Cities can encourage citizens to home composting to reduce the overall generation of Municipal Solid Waste. To promote such endeavours, cities should implement incentive schemes and increase awareness.

Initiate sanitary landfill construction while focusing on adopting sanitary measures for disposal and recycling of municipal solid waste and promoting waste to energy.

Management and operations of landfills should be according to the guidelines under the Swachh Bharat Mission (SBM) and align with section 2.8 from the Swachh Survekshan.

Important statistics:

- According to the “Swachhata Sandesh Newsletter” by the MoHUA, as of January 2020, 147,613 metric tonnes (MT) of solid waste is generated per day from 84,475 urban wards
- India is among the highest generators of waste globally, as per The World Bank report
- In 2017, 53 cities committed to setting up recycling facilities to recover material from C&D waste, although only 13 cities were able to achieve the same by 2020
- Presently, only five percent of the total municipal waste collected is processed in India. Untreated landfill sites account for approximately 20 percent of methane gas emissions in India

**Thematic information has been extracted from Cities Readiness Report, 2021.*

Photo Credit: Ekansh Goel

46

Good Practices

This section will help you learn and explore new opportunities that have been incorporated to achieve environmental sustainability, security, resilience, and inclusivity through climate action. Projects, big and small in size, together or individually, provide local governments with a way to identify the key areas that cities should focus on to accelerate the shift to a cleaner, more efficient, and just environment.

01

Building Climate Resilient Bio Parks

Coimbatore, Tamil Nadu

Timeline: *6 months*

Location: *Coimbatore, Tamil Nadu*

Scale: *Site scale*

Funding Agency: *GIZ India, Coimbatore City Municipal Corporation (CCMC)*

Policies/Schemes/Plans: *Climate Smart Cities Project, Corporate Social Responsibility (CSR)*

Agencies: *GIZ India, Coimbatore City Municipal Corporation (CCMC), Residents Welfare Association (RWA) for Marutha Nagar, Technical University Berlin (TU Berlin)*

Project Cost: *INR 11.8 million (USD 148,000)*

Alliance Partners: *GIZ India*

About the Project

The vision for the Marutha Nagar Bio Park is a pioneering example of a green community space that mitigates climate challenges while providing the residents with a friendly neighbourhood park. It also demonstrates practices in landscape architecture, environmental design, blue-green infrastructure design, social infrastructures, and ecological upgrading.

The project aimed at solving the urban green space challenge in Coimbatore using the urban design thinking (UDT) methodology. The idea was to look for small-scale solutions at the neighbourhood level that could be implemented, tested locally and replicated further in other parts of the city.

Objectives

Coimbatore wanted to increasingly adopt blue-green systems and strategic planning to increase urban resilience, green cover and reduce carbon emissions. The project enhances the social contract between the municipal administration and citizens through a participatory framework in developing, operating and maintaining the land.

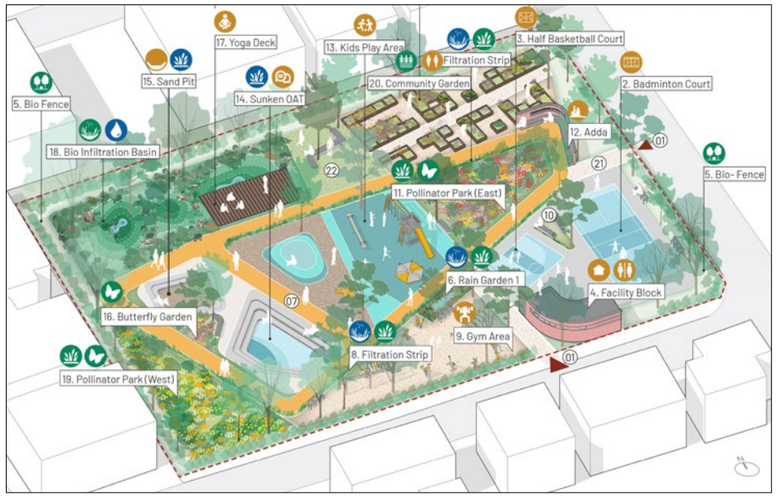
Through such pilots, there is potential for scaling up sponge open space networks in the city while also building long-term institutional efforts to address urban resilience and social integration.

Project Implementation

Marutha Nagar was identified as the pilot area, where workshops were held to develop prototypes of the bio-park. The results were transferred into a pre-feasibility study and detailed project report (DPR). This enabled the Coimbatore City Municipal Corporation (CCMC) to develop the neighbourhood space into a climate-resilient bio park. The proposed design adopted an integrated strategy for spatial programming and basic infrastructure like toilets, irrigation etc.

Multifunctional interventions proposed were:

> The green infrastructure included a bio fence, a butterfly garden, a community garden, a rain garden, and a pollinator park
> The blue infrastructure included a rain garden, a biofiltration basin, and methods to delay runoff and recharge the aquifer



Adopting blue-green systems to reduce carbon emissions

> The social infrastructure included a children's play area, a yoga deck, an outdoor gym, a sunken Open Air Theatre (OAT), walkways, and designated sports courts to increase visual and experiential appeal

All the elements were designed for energy efficiency, cost optimisation, sustainability, and easy maintenance. This park still needs to be taken up for implementation by CCMC.

Monitoring, Evaluation, and Management

The project will be implemented by CCMC. Monitoring and evaluation are jointly undertaken by GIZ India, CCMC and the residents welfare association (RWA) for Marutha Nagar. The CCMC validated and approved the proposed design, allocated funding for implementation and inspected the construction. The RWA was involved in the design and programming, from pre-feasibility to design details, where aspirations and requirements were incorporated.

Scalability

In a rapidly urbanising context like Coimbatore, open land serves as nodes for ecological, socio-cultural and civic infrastructures. Hence, scaling up integrated approaches will be essential to move towards a more climate-resilient Coimbatore. There is potential for the scalability of sponge open spaces to create a green city addressing urban resilience and social integration. The vision for the Marutha Nagar Park at the pilot project scale needs to be supported by both institutions and the community to ensure implementation success and long-term maintenance.

Challenges Addressed

> The green cover proposed the use of native species
> Social infrastructure was addressed through design interventions
> The project supports the mitigation of climate change consequences at a neighbourhood scale

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Gender Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 11.8 million

Who can help?

GIZ India, Coimbatore City Municipal Corporation (CCMC)

Why care?

Mitigation of climate change at a neighbourhood scale

Impact

> 58 tonnes of total CO_2 sequestration through the existing and proposed trees
> The total rainwater recharge potential of the park is 132,000 litres
> Apart from the trees, small plants in the pollinator parks, the butterfly garden, bio infiltration basin, rain gardens, infiltration strip and bio fence also aid in the purification of the environment through the absorption of pollutants and increase biodiversity
> The project implemented locally suitable prototypes that were gender and age sensitive

02

City ‘Green Corridors’ Beat the Heat

Medellin, Colombia

About the Project

Medellín was experiencing severe urban heat island effect and high pollution levels. In 2016, Medellín city started the Green Corridor project to expand greenery in public spaces, targeting heat islands in the urban areas with temperatures often significantly higher than in outlying or rural areas. This project used the term ‘Corridor’ because the goal was to provide an interconnected 20 km network of shade by transforming 18 roads and 12 waterways into a green space. As a result, almost 880,000 trees and 2.5 million smaller plants sprung up, helping improve air quality. The project has reduced the urban heat island effect by two degrees celsius since 2018. Medellín’s botanical gardens train people from disadvantaged backgrounds to become city gardeners and technicians.

Project Implementation

The 2016 to 2019 government plan of the Mayor’s Office of Medellín formulated the guiding principles for planning a sustainable, equitable city with greater environmental quality. The project was developed and implemented with 1,497,602 sq. m of public space intervened and built with the defined principles of environmental and urban quality. A network of architects was formed through public architectural competitions to develop the projects along with participatory methods.

Success Factors

Success factors include the identification of an environmental problem and the elements of inequality leading to a comprehensive decision-making process of the municipal administration oriented towards the citizens’ well-being. The project leveraged landscape architecture as a principle of urban design in public spaces to improve environmental quality.

Scalability

Project developers define an effective model to integrate nature-based solutions in cities that can be replicated to improve the quality of life. Some of the methods are urban environmental planning, improved air quality, seamless mobility, increased public spaces and consolidating healthier urban areas.

Timeline: *January 2016 to December 2019*

Location: *Medellin, Colombia*

Scale: *City scale*

Funding Agency: *City-funded*

Agencies: *Directorate of Strategic Urban Projects, Secretariat for Infrastructure, Directorate of the Administrative Department of Municipal Planning, Environment Secretary, Urban Development Company of Medellín*

Project Cost: *CapEx- INR 1.01 billion (USD 16.3 million), O&M costs - maintaining green corridors at INR 93 (USD 1.50) per sq. m every quarter by 150 gardeners*

Alliance Partners: *GBCI*

Transforming roads to green spaces

Challenges Addressed

- Reduction of air and surface temperature in the areas with green corridors
- Prevention of further discomfort and issues due to an urban heat island effect
- Addressing the city’s morbidity rate from acute respiratory infections through green plantation drives
- Improved water management of the city’s hydrological system through green corridors and linear parks
- Increased biodiversity in fauna and flora in urban centres and peripheries stemming from natural vegetation
- The main challenge is maintaining the dynamics of urban development and implementing Nature-based Solutions in the long term, notwithstanding different political perspectives at the city level. It is key to ripen the benefits of nature and ensures the continuity of welfare-oriented social and urban programs

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 1.01 billion

Who can help?

USGBC/GBCI

Why care?

A 20 km green network improved air quality

Impact

- Health Improvement: The PM 2.5 level was reduced by 1.55 µg/m3, and the city’s morbidity rate from acute respiratory infections decreased from 159.8 to 95.3
- Improved Skilling: 75 locals from disadvantaged backgrounds were trained by Medellín’s Joaquin Antonio Uribe Botanical Garden to be city gardeners and planting technicians
- Environmental benefits: The city achieved a reduction in the average temperature by 3.5°C and the average surface temperature by 10.3°C

03

Equitable Eco-Mobility Corridor

Gurugram, Haryana

Timeline: *2015 to 2018*

Location: *Gurugram, Haryana*

Scale: *Site scale*

Funding Agency: *iamgurgaon (NGO) and State Forest Department, Haryana, Corporate Social Responsibility (CSR)*

Agencies: *iamgurgaon (NGO), State Forest Department, Haryana, VSPB Associates*

Project Cost: *INR 140 million*

Alliance Partners: *Gurgaon Municipal Corporation*

About the Project

The Chakkarpur-Wazirabad Bundh project was an inclusive collaborative initiative between the Department of Forest of the Haryana government, a citizens' group called iamgurgaon, Corporate Social Responsibility (CSR) sponsorship and the design consultants. The initiative's primary objective was to develop a greener city for future generations. The project aimed to create a public place and a self-sustaining eco-mobility corridor. The linear park provides non-motorised linkages throughout the city, creating a 'green lung' for Gurugram. The purpose was to rebuild the derelict bundh as an ecological network, transform the urban backyard into an alternative mobility corridor, and rejuvenate it as a vibrant urban public space.

The bundh was historically built as an earthen check dam to serve as an efficient water retention system for the city. Over the years, this had been encroached upon and reduced to a garbage dumping ground and open defecation area. The Bundh Eco-Restoration Project is conceived as a pioneering citizen-driven, urban regeneration initiative to rejuvenate the neglected corridor as a barrier-free nature park.

Project Implementation

A highly effective rainwater harvesting system was established with the help of French drains, subsurface piping and recharge pits. An excellent solid waste management system was created with compost pits to collect biodegradable waste and enable the on-site generation of plant manure. It also uses renewable energy methods for lighting solutions through solar lights.

The land came under the jurisdiction of the Haryana government's forest department. The proposal looked into aspects related to the existing land uses of accessibility and mobility around the site, the existing sectional profile of the bundh and its relation to the nullah. It suggested design possibilities for a pilot stretch, 200 m long, on how to improve the area's quality and bring this lost space back into the urban landscape of Gurugram. To conserve natural resources and reduce project costs, divergent ways of recycling materials have been carried out. For example, 35,000 cubic metres of construction debris from landfills and construction sites in Gurugram have been utilised for earth-fill operations.

Linear Park Schematic Diagram

Dedicated tracks for cyclists

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Gender Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 140 million

Who can help?

Gurgaon Municipal Corporation

Why care?

35,000 cubic metres of construction debris used for earth-fills

Impact

- Once deemed a derelict, unusable area, the rejuvenated bundh is now a landmark public place
- A unique example of using various techniques to make the project climate sensitive through compost pits, rainwater recycling, reuse of construction waste, and renewable methods of lighting
- The safe space has provided an opportunity for women to use this corridor freely
- Presents methods of reusing construction debris in new projects

04

Expanding Heat Resilience Across India

Ahmedabad, Gujarat + 130 cities in India

Timeline: *2013 onwards, annually*

Location: *Ahmedabad, Gujarat*

Scale: *City scale*

Funding Agency: *Ahmedabad Municipal Corporation*

Policies/Schemes/Plans: *Early Warning Systems and Heat Preparedness Plan*

Agencies: *Ahmedabad Municipal Corporation for Ahmedabad project, Natural Resources Defense Council (NRDC), Public Health Foundation of India (PHFI), Indian Institute of Public Health-Gandhinagar (IIPH-G), Mahila Housing Trust (MHT)*

Project Cost: *Variable cost per year*

Alliance Partners: *UNEP*

About the Project

Heat action plans (HAPs) are comprehensive extreme heat early warning systems and preparedness plans. Since the groundbreaking Ahmedabad HAP in 2013, the first in India and South Asia, Natural Resources Defense Council (NRDC) and its partners have collaborated with cities and states in India to craft their early warning systems and heat preparedness plans. India's National Disaster Management Authority (NDMA) included extreme heat as a recognised disaster. India's national government is working with 23 heatwave prone states and over 130 cities and districts to develop and implement HAPs across India.

Heat stress hits the poor the hardest, with people living in slums and low-income communities particularly vulnerable to health hazards. Extreme heat exposures are already a public health emergency in India that killed an estimated 46,600 people aged 65 or older in 2019. Coordinated actions that strengthen heat resilience, across public and private spheres, in historically hot areas and, more recently, heat-vulnerable areas are crucial.

Objectives

The key objectives of HAPs include the following:

> Improving public awareness and community outreach
> Facilitating inter-agency coordination
> Context-specific capacity building among healthcare professionals
> Reducing heat exposure
> Promoting adaptive measures

Project Implementation

Other than collaboration to create contextual heat action plans for cities, more than 7,000 cool roofs have been painted for low-income households. The cool roof demonstrations in Jodhpur, Bhopal, Surat, and Ahmedabad covered more than 460 roofs and reached 13,587 households and 67,935 individuals with information on solar reflective paint.

Further engagement with the community was undertaken through the following:

> Schools flagging the program to protect and teach school children
> Engagement between civil society partners and technical experts for research, analysis and training
> Front-line communities supported by working towards adaptation

A makeshift shelter erected in Ahmedabad, Gujarat for a cobbler to work under

Monitoring, Evaluation, and Management

Cost of HAP development and implementation are usually included within the municipal corporation's budgetary allocations. The cost of personnel being shared with existing programmes and the cost of infrastructure and capacity building being broken up over multiple years.

After every heat season, the city or state must assess the efficacy of its heat action plan, including the processes, outcomes, and impacts. Stakeholders should identify the changes and improvements needed. The plan should subsequently be updated, where key officials and participants are made aware of the modifications.

Activities from the city or state's departments should be monitored continuously so that problems can be identified and addressed in a timely manner. This monitoring would also inform the critical evaluation of the heat plan.

Scalability

As more cities in India are experiencing a rise in heat levels and the creation of urban heat islands, the heat action plan can be formulated in any city with the help of expert organisations with localisation at its core.

Challenges Addressed

Some of the issues experienced and addressed through the HAP:

> Focuses on the drastic shift in climate conditions such as extreme heat, heatwaves and seasonal shifts, striking periodically with higher intensity and frequency.
> Focussed on extreme heat exposure mitigation of vulnerable communities since they are the most affected social segment without the financial ability or capacity to handle it.
> Promoted coordinated actions to strengthen heat resilience and city-to-city learning.

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

Variable cost per year

Who can help?

UNEP, Ahmedabad Municipal Corporation

Why care?

6.4 million lives have been positively impacted by the Heat Action Plan

Impact

> Launching South Asia's first HAP in Ahmedabad in 2013 has been linked to the prevention of more than 1,100 deaths in subsequent heat waves
> Overall, 6.4 million lives have been positively impacted by the Heat Action Plan
> The Ahmedabad HAP is a leading example of urban heat adaptation in the Intergovernmental Panel on Climate Change Working Group II (IPCC) report on climate impacts and adaptation

05

Land's End Precinct

Bandra, Mumbai, Maharashtra

Timeline: *Completed in 2002*

Location: *Mumbai, Maharashtra*

Scale: *Site scale*

Funding Agency: *Bandra Bandstand Residents' Trust*

Policies/Schemes/Plans: *Corporate Social Responsibility (CSR) initiative, Members of Parliament Local Area Development Scheme (MPLADs)*

Agencies: *Bandra Bandstand Residents' Trust, Municipal Corporation of Greater Mumbai (MCGM)*

Project Cost: *INR 9 million*

Alliance Partners: *Municipal Corporation of Greater Mumbai (MCGM)*

About the Project

Land's End is a peninsular strip of land that juts into the sea, with a fort, a declared heritage precinct. At a height of 20 to 35 metres, bounded by the Mahim Bay and the Arabian Sea, it commands a sweeping view of the coast. Most of the sloping stretch had been extensively excavated and destroyed to make way for private gardens of adjacent hotels, leaving a clutch of trees, some overgrown ruins and untended patches.

The project planned to conserve, restore and develop the existing ruins appropriately while establishing the palm forest that once stretched over its slopes. To expand the association with the area, the project envisaged a gallery of steps and a stage amid the palm trees for regular cultural and art shows.

Objectives

The project's objective was to reclaim various forts and precincts by turning them into public spaces. This integration would help protect and maintain historic sites and monuments. Secondly, it restored the natural green cover of the area to prevent soil erosion.

Project Implementation

The project attempted to retain and enhance the site, both as a historical precinct as well as an active public space with lighting, signage, seating, landscaping and pathways, all executed with minimal intrusion. Built on the slopes of the hill, stone edging and grass steps ensure that the gallery befits a forest-like environment.

Scalability

It is necessary to develop similar fort ruins through conservation and plan the area around as public space and protected fort precincts. Connecting them to neighbourhoods can prevent isolation and abuse, making history a part of everyday life.

Challenges Addressed

- Like all other common assets of the city, the natural sea barriers had been severely misused with the removal of the green cover with private encroachment and foreign plantation
- The lack of public access to the water edge

Revival of the precinct by establishment of palm forest

Amphitheatre for cultural events on the reclaimed area

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 9 million

Who can help?

Municipal Corporation of Greater Mumbai (MCGM)

Why care?

Flood prone historical fort restored to prevent soil erosion

Impact

- The project restored the hill slope and its contours, originally dug up by a hotel to create a garden lacking relevance to the immediate natural and historical environment
- Such forestation, including medicinal plants identified by the World Wildlife Fund, was used to arrest soil erosion and restore the original environmental character of the hill
- The project envisaged a gallery of steps and a stage amid the palm trees for regular cultural and art shows to expand the association with the area

06

Local Biodiversity Strategies for Conservation

Kochi, Kerala

Timeline: *2 years*

Location: *Kochi, Kerala*

Scale: *City scale*

Funding Agency: *The German Federal Ministry for the Environment (BMU), Kochi Municipal Corporation (KMC)*

Policies/Schemes/Plans: *National Biodiversity Targets, City Biodiversity Index (CBI) and Local Biodiversity Strategy and Action Plan (LBSAP) under the City Smart Climate Assessment Framework (CSCAF)*

Agencies: *Kochi Municipal Corporation (KMC), Centre for Heritage, Environment and Development (c-hed), ICLEI South Asia*

Project Cost: *Not Specified*

Alliance Partners: *ICLEI South Asia, Kochi Municipal Corporation (KMC)*

About the Project

Kochi is the first city in India to develop a scientifically informed and participatory City Biodiversity Index (CBI) and Local Biodiversity Strategy and Action Plan (LBSAP). The project aims to provide expanding urban communities in the global south with nature-based solutions. It is designed to improve the utilisation and management of nature within fast-growing cities and the regions surrounding them. It provides an overview of key issues, constraints and opportunities identified during the extensive consultation meetings carried out with various stakeholders in the city.

Objectives

The project's objective is to strengthen the integration of biodiversity management as a cross-cutting task and facilitate cooperation at several levels - local, sub-national and national. The project targets city regions with globally recognised biodiversity hotspots that face urban development pressure. The city identified nine critical focus areas - agriculture, air, avenue trees, green and open spaces, inland water bodies, islands, lakes, marshes and mangroves, seashore and sandbars.

Project Implementation

For the city of Kochi, LBSAP helps define the implementation of the vision, strategic objectives and actions necessary for the city's conservation and biodiversity protection. The CBI of Kochi involved primary and secondary data collection with GIS-based mapping for each of the 23 indicators.

It is based on the inputs received during multiple consultation meetings at the city and ward level, discussions with municipal corporation councillors, and subject experts. To address the gaps in biodiversity conservation and governance, the city of Kochi developed the LBSAP in four stages:

> Stage one: Carried out background research on biodiversity-related issues in Kochi
> Stage two: The research outcomes presented in a city-level meeting helped identify critical ecosystems within the city and the drivers impacting the health of these ecosystems
> Stage three: Detailed zonal-level meetings helped understand ward-level problems
> Stage four: Findings were analysed and presented to a technical working group whose suggestions helped finalise the LBSAP

The LBSAP has a vision for each of the nine critical ecosystems previously defined. It has been developed in line with the National Biodiversity Strategies and Action Plan (NBSAP) and feeds into 12 national biodiversity targets.

Proceedings of consultation workshop for developing Local Biodiversity Strategy and Action Plan (LBSAP)

Monitoring, Evaluation, and Management

Post the creation of the LBSAP, the city now regularly adds action points on biodiversity suggested into the municipal budget and undertakes the implementation accordingly.

Scalability

The actions suggested in the LBSAP for each critical ecosystem can be up-scaled to other cities in the state.

Challenges Addressed

Identifying a suitable basic unit for consultation meetings was essential for the project's timely completion since Kochi Municipal Corporation has 72 wards. Rather than conducting ward-wise meetings, zonal meetings were conducted by grouping wards with standard geographical and ecological features. This optimised timeframes, data analysis and expenditure.

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

Not Specified

Who can help?

ICLEI South Asia

Why care?

Enables biodiversity conservation through municipal budgeting

Impact

> The participatory approach in developing the LBSAP increased ownership and focussed on traditional knowledge
> The commitment of the municipal corporation towards protection and conservation through specific funds helped improve biodiversity
> Kochi's LBSAP contributes to the achievement of national commitments and the 2020 global biodiversity framework in a scientifically informed manner
> The City Biodiversity Index (CBI) enables progress towards biodiversity conservation while highlighting problem areas and strategies at the local level for a liveable city

07

Plant, Grow and Track

Freetown, Sierra Leone

Timeline: *January 2019 to 2022*

Location: *Freetown, Sierra Leone*

Scale: *City scale*

Funding Agency: *World Bank Group and Global Environment Facility (GEF)*

Policies/Schemes/Plans: *Transform Freetown Strategy, Sustainable Cities Impact Programme, Resilient Urban Sierra Leone Project*

Agencies: *Freetown City Council (FCC), World Bank Group, The Environmental Foundation for Africa, Greenstand, Global Facility for Disaster Reduction and Recovery (GFDRR)*

Project Cost: *INR 4.6 billion (USD 56.7 million)*

Alliance Partners: *UNEP*

About the Project

After suffering a deadly landslide in 2017 that left more than 1,000 people dead or missing, Freetown launched a comprehensive action plan called Transform Freetown in January 2019. A significant part of the initiative is the 'Freetown the TreeTown' campaign, where the Freetown City Council partnered with other institutions to plant, grow and track one million trees over 2020, 2021 and 2022 rainy seasons. These trees are being tracked through an application launched by the city. Part of wider program Resilient Urban Sierra Leone Project, the total project cost between 2021 to 2026 is INR 4.6 billion.

Freetown hosts 40 percent of Sierra Leone's population, and 100,000 people migrate to the city each year. The urban fringes continue to push into the forest expanses outside the city, leading to an equivalent of 12 percent of the canopy area lost annually between 2011 and 2018. This directly affects water reserve catchment areas, exacerbating landslides, flooding, and coastal erosion risks.

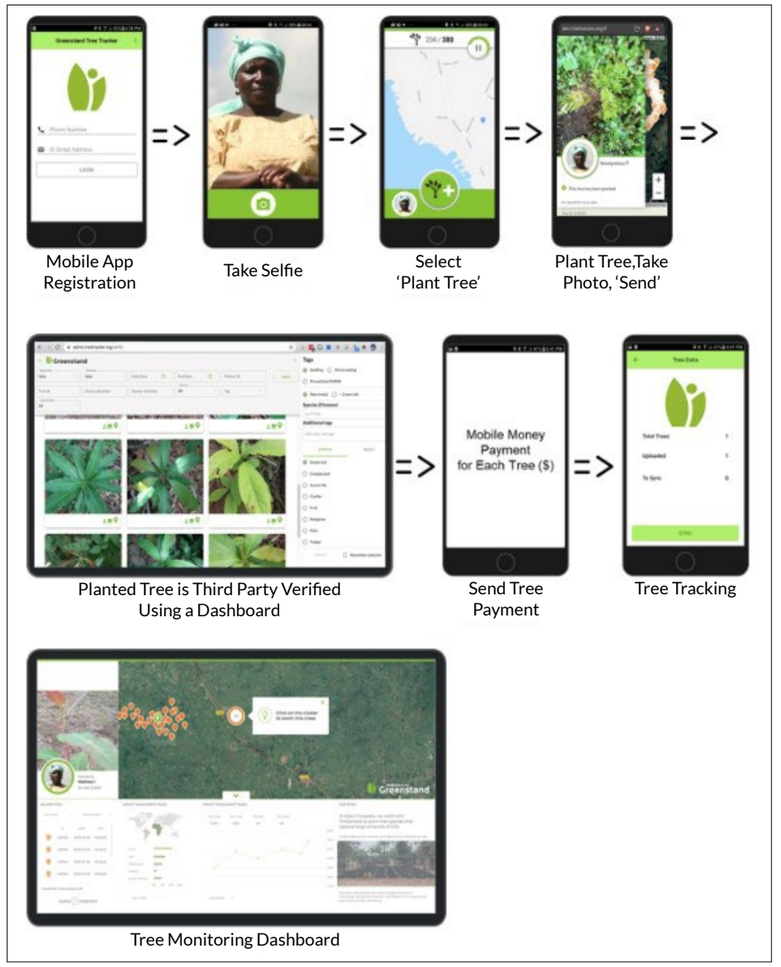
Objectives

The strategy aims to reshape the capital into a productive, liveable, and resilient city by improving urban governance, investing in resilient infrastructure, and promoting urban greening. By restoring hillsides and increasing the amount of green space in the city, the campaign hopes to reduce the likelihood and severity of future flood events and increase the ability of the city's soils to absorb excess rainfall when it occurs.

Project Implementation

In the initial 2020 to 2021 phase, 250,000 trees were planted and tracked, focussing on higher slope areas where communities were susceptible to landslides. Further, with 10 commercial tree nurseries and 10 community-based organisations, the project created 550 short-term jobs, especially for the marginalised, vulnerable, and underemployed women and youth. An extra 50,000 mangrove trees will be planted to restore damaged coastal wetlands.

Tree IDs created can be turned into 'impact tokens', which businesses and individuals can buy, sell, and trade to generate new revenue streams to fund more tree planting. The project has sold its first 5,000 tree impact tokens, and the revenue will provide financing for an additional 5,000 trees. A total of 700,000 trees are being planted along roads, water sources, and critical infrastructure within communities, neighbourhoods, and public spaces. Implementation will be complete at the end of 2022.



Tree-tracker mobile app tree monitoring processes
Source: World Bank

Monitoring, Evaluation, and Management

Publicly available, real-time tree monitoring through a map increases the ability to monitor progress and ensure a high level of transparency. Additionally, the Freetown City Council and the World Bank conduct an overall project monitoring and evaluation.

Scalability

Similar projects can be replicated in other developing and emerging economies that aim to achieve increased tree canopy cover for climate resilience while engaging the community.

Challenges Addressed

Some of the challenges addressed in the project are:

- Establishing long-term climate resilience for the local community
- Reversing the loss of tree canopy and vegetation to reduce heat stress
- Helping improve the air and water quality
- Reducing flooding and landslide risks
- Enhancing biodiversity and ecosystem services
- Creating employment opportunities for local youth
- Using technology to ensure transparency and outreach

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Gender Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 4.6 billion

Who can help?

UNEP, Freetown City Council (FCC)

Why care?

Community ownership ensured an 80 percent tree survival rate

Impact

- Created a unique geotag for each new tree through an innovative, sustainable tree growing model
- Trained 800 community climate ambassadors, benefitted 300 communities, and 550 short-term jobs created
- Planted 250,000 trees and replenished 50,000 mangroves
- Encouraged residents to participate in maintenance efforts
- Increased canopy cover in 11 health facilities, 100 schools, seven dams, 37 government buildings, 66 religious institutions, 48 communal planting areas, 58 roads, more than 20,000 private properties and 12 waterways

08

Reviving Irla Nullah

Mumbai, Maharashtra

Timeline: *2013 onwards*

Location: *Mumbai, Maharashtra*

Scale: *Neighbourhood scale*

Funding Agency: *Municipal Corporation of Greater Mumbai (MCGM)*

Policies/Schemes/Plans: *Vision Juhu Plan*

Agencies: *PK Das & Associates, National Environmental Engineering Research Institute (NEERI), Municipal Corporation of Greater Mumbai (MCGM), IIT Bombay*

Project Cost: *Not Specified*

Alliance Partners: *National Environmental Engineering Research Institute (NEERI)*

About the Project

The Irla Nullah is part of a larger project, Vision Juhu Plan, that includes conserving reserved open spaces and creating new ones with a pedestrian focus. It also aims at effective solutions to flooding, development of the nullah, protection of the natural environment and increasing commercial viability. It encourages tourist and leisure facilities, protection and support of communities and enables social inclusion by giving people a voice in landscapes of rapid change through designing urban places and spaces for them.

The Irla Nullah runs through the western suburb of Juhu with a total length of 7.5 km Owing to its geographical footprint, most neighbourhood areas have direct access or are in close proximity to the water body. A host of public institutions and amenities are found adjacent to this nullah. The re-invigoration proposal aims to interconnect these amenities and open spaces to the nullah to increase participation and improve the vigilance of these public spaces.

The major floods of 2005 brought the city to a complete standstill for several days with high loss of human lives and property. A committee was set up to suggest measures to the Municipal Corporation of Greater Mumbai (MCGM) to prevent such incidents in the future.

Objectives

> The project proposes a comprehensive view of a plethora of public spaces, natural areas and their networking
> These include conserving ecological assets and their integration with the neighbourhood and the city
> Primarily affecting a paradigm shift in the understanding of sustainable ecology and building with nature

Project Implementation

One of the project's focal points, the key to the success of the re-appropriation and re-invigoration of the nullah, was the challenge of cleaning the water. The design team worked closely with the National Environmental Engineering Research Institute (NEERI) to develop a water-cleaning system. This system comprises several elements - floating matter filtration gates, silt trap beds, compact treatment units and floating beds with phytorid plants.

The Irla Nullah re-invigoration project phase 1 proposal

Pedestrian and cycle path with landscaping along the Irla Nullah

There was participation from local citizens, elected representatives, government officials, celebrities, educational and commercial institutions, the MCGM and certain state and national government agencies. The project exemplified the need to involve diverse stakeholders in the people's 'Right to the City' and their role in scripting its urban growth.

Challenges Addressed

The challenges were significant, such as:

> Addressing the issues of watercourses, including rivers that had been turned into nullahs or drains
> Targeting the degradation of natural areas in the city, including mangroves, wetlands, creeks, salt pans, rivers, lakes, beaches, hills and forests
> Demystifying the planning process and promoting the idea of bottom-up neighbourhood-based city planning

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

Not Specified

Who can help?

NEERI, Municipal Corporation of Greater Mumbai (MCGM)

Why care?

Building with nature along a 7.5 km water body through stakeholder involvement

Impact

> Expanding public spaces both in physical and democratic terms
> Building with nature and incorporating the conservation of vital natural assets
> Evolving urban governance models and systemic change in city institutions
> Expanding the opportunities for citizen engagement and implementing project execution through participation

09

Tackling Heat for Health: A City-Community Approach

Louisville, Kentucky, USA

Timeline: *2012 onwards*

Location: *Louisville, Kentucky, USA*

Scale: *City scale*

Funding Agency: *Louisville Metro Government funds*

Agencies: *Green Heart Louisville program - University of Louisville's Envirome Institute, Residents of the high-heat Parkland neighbourhood, Metro Government officials*

Project Cost: *Not Specified*

Alliance Partners: *USGBC/GBCI*

About the Project

This program is the first and only controlled study investigating urban greening as though it were a pharmaceutical intervention. Louisville's journey to address urban heat began in 2012 when the city undertook a comprehensive Urban Heat Management Study. The first assessment of its kind conducted by a major city, the study found that temperatures in downtown Louisville can be up to 10°C higher than in surrounding areas. Around the same time, the Urban Climate Lab identified Louisville as the fastest-growing urban heat island of all the surveyed cities.

Sharing replicable strategies and effective approaches certified LEED cities have taken, helps other cities and towns also advance and progress. The case study from Louisville highlights the challenges and path forward for reducing urban heat and improving the quality of life in warming cities for permanent and transient communities, especially socio-economically weaker sections.

Since identifying Louisville's urban heat problem, local leaders have moved quickly to identify effective strategies for mitigation and adaptation. Because urban heat does not affect all residents equally, sustainability and planning staff must also address the impacts of historical inequities. Across Louisville, tree coverage is low, and temperatures are higher in historically redlined neighbourhoods. Furthermore, low-income community members have fewer resources to help them stay cool.

Objectives

> Addressing the urban heat island effect, an issue experienced in most urban regions around the world
> Creating incentivisation for the community to participate in climate mitigation
> Reducing the cost of energy to cool indoor spaces in a city

Project Implementation

The following measures were undertaken:

> Investment in cool and reflective roofs through the Cool Roof Rebate Program offers a INR 62 per sq. ft. (USD 1) rebate for installing an Energy Star roof on any property
> The Green Heart Louisville program was introduced to test the effects of greening on health and well-being in high-heat neighbourhoods
> Planting trees along highways and in residential areas
> Public and private partners to conduct environmental monitoring and medical evaluations to find potential correlations with heart disease, diabetes, stress, and social ties
> Partial de-paving of pathways with the installation of cool pavements

Installation of cool pavements

Planting trees along highways

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

Not Specified

Who can help?

USGBC/GBCI

Why care?

Over 71,000 sq. m of cool roofs incentivised

Impact

> Since 2017, the Cool Roof Rebate Program has incentivised the installation of over 820,000 sq. ft. of cool roofs
> In addition to cooling the city, property owners who install light or reflective roofs save seven to fifteen percent on the cooling costs
> The community-driven transformation of Parkland Plaza from an unused, city-owned parking lot to a sustainable neighbourhood green space has been remarkable

10

Technology for Urban Flood Management

Kochi, Kerala

Timeline: *2017 to 2020*

Location: *Kochi, Kerala*

Scale: *City scale*

Funding Agency: *GIZ (BMUV)*

Policies/Schemes/Plans: *Smart Cities Mission*

Agencies: *Kochi Municipal Corporation (KMC), Cochin Smart Mission Limited (CSML), GIZ India*

Project Cost: *Not Specified*

Alliance Partners: *GIZ India*

About the Project

The Flood Free Kochi app is an application that helps in identifying water clogged and areas with maintenance issues using crowd sourcing. The Federal Ministry for the Environment funded the ICT (Information and Communications Technology) based adaptation to climate change in cities project under Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) and the International Climate Initiative (IKI). The ICT-A project supported implementation in the smart cities of Bhubaneswar and Kochi. Flood Free Kochi is an ICT-A-based solution developed by GIZ in close cooperation with the Kochi Corporation and other stakeholders, including citizens.

Project Implementation

The android and iOS-based app collects data from multiple locations in Kochi, where water logging is rampant during the rainy season. It also has an added feature of reporting obstacles on the street, like fallen trees, garbage dumps, and potholes, serving as an overall cleaning and maintenance tool for the Kochi Municipal Corporation and its citizens.

The crowd-reporting application engages citizens and city officials as volunteers. On seeing a drain needing cleaning or de-clogging, a citizen marks the location on the app with the necessary image. The issue can be reported to the command centre or authority with a brief description and pictures/videos for clarity.

The command centre system then identifies the location and notifies the supervisors in that area for immediate action. The supervisor has to solve or direct the issue to the necessary agencies. This enables the officials to ensure timely maintenance of the critical points ahead of the monsoon season and prevent urban floods.

The entire process is recorded at the command centre and is available to the reporting volunteer regarding the action taken. The app is successful only because of the active participation of the volunteers.

Inadequacies and Learnings

There is a need for more media coverage to make citizens aware of the app and its utilisation for grievance redressal.

Interface of the Flood Free Kochi application

Success Factors

Some of the project and app's success factors are:

> Developing an early response system for reporting an incident related to drain clogging and deploying response teams for immediate on-ground action
> Mitigating the impacts of urban flooding to reduce economic and human loss
> Once agencies integrate, other issues apart from flooding and roadblocks can also be reported. This will use modern GPS systems for reporting issues like heavy traffic, where anyone can update it within the app

Scalability

The same app can be contextualised as per the city's needs for services like air pollution, seamless mobility, urban heat island and other climatic conditions. Later, this data can be used for weather forecasting, and the app can create a daily warning system.

Challenges Addressed

> Mitigate urban flooding
> Reduce the loss of workforce, injuries, infrastructure damage, and vegetation damage due to flooding
> Mitigate economic loss
> Reducing the damage to properties due to disasters
> Data protection due to extensive public involvement and open sources
> Prevention of false/under/over-reporting of issues in the city due to citizen engagement
> Integration of agencies and their process is challenging. However, it is envisioned through a single-window system

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

Not Specified

Who can help?

GIZ India

Why care?

Crowd reporting app engaged citizens with officials as volunteers

Impact

> Increase in efficiency of government services
> Faster reporting system
> GIS, GPS and visual data collection from all parts of the city
> Mapping and trend analysis for further infrastructure development

11

The Kawaki Initiative

Kochi, Kerala

Timeline: *September 2019 to December 2022*

Location: *Kochi, Kerala*

Scale: *City scale*

Funding Agency: *Norway International Climate and Forest Initiative (NICFI), Department of Environment Food and Rural Affairs (Defra)*

Policies/Schemes/Plans: *Pachathuruth Program, Kawaki Initiative, Ayyankali Urban Employment Guarantee Scheme, Kudumbashree Mission , Cities4Forests Initiative*

Agencies: *Kochi Municipal Corporation, Centre for Heritage, Environment and Development (c-hed); WRI, CSES*

Project Cost: *INR 15,000 for 400 sq. m containing 100 tree saplings; maintenance at INR 2,500 per month*

Alliance Partners: *WRI India*

About the Project

Kochi city was India's first city to join and become the founding member of the Cities4Forests global initiative in 2018. Through the Cities4Forests initiative, WRI India conducted an intensive participatory 'mapathon' exercise in 2020 with local councillors, Resident Welfare Association (RWAs) members and students, identifying green restoration potentials in two major wards in Kochi. Consultations were held with local community members with the help of Kudumbashree, a community-based organisation that is part of the Local Self Government Department in Kerala, to understand the priorities. Further, the Urban Community Resilience Assessment (UCRA) framework, an evaluation structure and bottom-up process developed with support from the Cities Alliance – Joint Work Program on Resilient Cities, was implemented across four vulnerable neighbourhoods to assess the individual and community's differential coping capacities. It generated several critical spatial maps to make an evidence-based analysis of the different environmental and social vulnerabilities. The guidance document incorporates aspects of Nature-based Solutions (NbS) and community resilience to highlight the urban restoration plan. This also empowers social networks and vulnerable communities to create robust and locally relevant rescue, recovery, and resilience measures.

Objectives

> Addressing urban heat and flood mitigation is critical
> Increase of green cover and conservation of urban green cover
> Creating sustainable civil models to create and conserve green spaces
> The lack of awareness of the multiple benefits of Nature-based Solutions (NbS) needs to be addressed through intensive capacity building and evidence-based implementation of pilot projects
> Designing the strategy based on the local community's and stakeholders' needs and understanding the limitation in resources and preferences is critical

Project Implementation

A 'Mapathon' event, through a multi-stakeholder workshop, spatial maps was collected to understand the potential locations for urban greening.

Kawaki Initiative, where small urban grooves replicating traditional grooves or kavu were developed in the available patches. By 2022, Kawaki forests were developed in multiple locations across the city with the support of public institutions, residential societies, Kudumbashree units and even private stakeholders.

Participatory Mapathon exercise

Monitoring, Evaluation, and Management

Capacity building for the local stakeholders for maintenance - weed removal, watering, and protection. Ward councillors of each site are also assigned the responsibility of monitoring and evaluation. As part of the guidance document - City Disaster Management Plan (CDMP), WRI India consulted with experts to frame a roadmap for CDMP Kochi and enabled the city to look and act toward NbS for adaptation.

Scalability

Under the pilot demonstration, over 15 kawaki sites were developed. There is scope for scaling up in any urban area in India under a similar model of developing micro-urban grooves.

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 15,000 for 400 sq. m

Who can help?

WRI India

Why care?

Over 10,000 sq. m of space for green cover conserved

Impact

> A guidance document was developed to lead the vision on long-term climate resilience
> The result reflected the inclusion of blue-green infrastructure projects in municipal budgets with NbS strategies demonstrated at multiple sites in Kochi
> Through the Cities4Forests project, Nature-based Solutions have gained attention among multiple stakeholders in Kochi
> Over 1,200 tree saplings planted

12

AI for Energy Saving

Pimpri-Chinchwad, Maharashtra

Timeline: *2018 to 2019 onwards*

Location: *Pimpri-Chinchwad, Maharashtra*

Scale: *Site scale*

Funding Agency: *Private Funding*

Policies/Schemes/Plans: *India Cooling Action Plan, Risk Guarantee Funds/Schemes, Blended finance schemes*

Agencies: *Kaer, Elpro International*

Project Cost: *Not Specified*

Alliance Partners: *UNEP*

About the Project

Kaer designed the Heating, Ventilation and Air Conditioning (HVAC) system for the Elpro Business Park in Pune. This involved setting up of 700 tonnes of refrigeration (TR) air conditioning chiller plant on the premises, delivering cooling to the buildings through underground pipelines and air distribution systems installed at tenant locations. The cooling plant operations are managed by an Artificial Intelligence (AI) driven software platform for enhancing energy efficiency.

Objectives

Elpro International signed a Cooling-as-a-Service (CaaS) contract for operating the cooling systems for a period of 15 to 20 years. Residents, office workers and users in the business park only pay for the cooling service they receive, while operation, maintenance and repairs are provided by Kaer.

Project Implementation

The implementation, the cooling system was set up with energy and cooling performance measurement systems, which monitor the continuous data from the energy use equipment. This monitoring system helps Kaer in billing the clients and in managing the operations and maintenance of the systems.

The project is currently operating the facility with zero-carbon energy use by increasing energy efficiency, which reduces the energy demand. It also supplements the energy requirements of the cooling system using renewable energy. This laid a platform for future commercial and mixed-use developments to engage with CaaS service providers to achieve cost-effective and clean cooling systems.

Monitoring, Evaluation, and Management

> The entire system is run and monitored remotely from centralised operation centres and smart devices
> Operation of the cooling plant is automatically managed by the AI-based software platform, with the facility operators working solely on system initiation and shutdown
> Preventive maintenance of the systems is carried out with support from data measurement systems and software platforms

Inadequacies and Learnings

The suggested solution through CaaS requires a much lower cooling load compared to standard air conditioning systems because the air-side systems operate in a part-time part-space mode. Automating air conditioning in such a way that it operates only when needed and when the spaces are occupied.

Elpro business park, Pune

The HVAC system for the business park was designed by Kaer

The AI-driven algorithms help to optimise the operation of the system. The traditional air conditioning systems on the other hand operated in the full-time-full-space mode, limiting occupants' control of the operation.

Scalability

Buildings with high cooling demand and more operational hours and mixed-use developments can utilise the CaaS business model for incorporating energy-efficient and clean cooling in their buildings. Allied sectors are data centres, cold stores and processing centres, airports, etc.

Challenges Addressed

> High-efficiency cooling system with energy requirements supplied by 100 percent renewable electricity from solar photovoltaic systems
> Multiple user types (commercial, retail, residential, institutional etc) receive thermal comfort and indoor air quality at zero capital cost and cheaper monthly operating bills

How much?

Not Specified

Who can help?

UNEP

Why care?

Reduced operational costs for the customer by up to 30 percent

Impact

> Zero energy footprint for the cooling systems in the building (accounting for approximately 50 to 60 percent of the total energy use).
> Supply of healthy, clean and fresh air to the users in the buildings
> Reduced operational costs for the customer by up to 30 percent
> Mitigation of Greenhouse Gas (GHG) emissions of up to 5,000 tonnes of CO_2 equivalent emissions per year

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

13

Air Conditioner Replacement Scheme

New Delhi

Timeline: *30 months*

Location: *New Delhi*

Scale: *City scale*

Funding Agency: *Rebate-based scheme approved by the regulatory commission*

Policies/Schemes/Plans: *BSES Rajdhani Power Ltd (BRPL) AC replacement scheme*

Agencies: *Delhi Electricity Regulatory Commission (DERC), BSES Rajdhani Power Ltd (BRPL). Air Conditioning original equipment manufacturers like Voltas, Godrej, LG, Daikin, Blue star and Lloyd*

Project Cost: *INR 43 million*

Alliance Partners: *UNEP*

About the Project

Under BSES Rajdhani Power Ltd (BRPL) air conditioning (AC) replacement scheme, BRPL domestic consumers from Delhi can exchange any of their old working energy inefficient ACs with Bureau of Energy Efficiency (BEE) five-star rated energy efficient ACs at up to 60 percent discount. A consumer can exchange up to three ACs under the scheme per one consumer account number. The old collected inefficient ACs were disposed of in environmentally friendly disposal methods by authorised agencies.

Objectives

> Promotion of five-star rated (energy efficient) appliances
> Promoted energy saving tips to become common knowledge

Project Implementation

> All types of BRPL domestic consumers can register their requests through consumer help desks at divisional offices or through BRPL portal
> The BRPL has a dedicated query/complaint cell which is available on the website. The scheme sets up details, including a list of available models and a link for online registration, which are displayed on the BRPL website home page
> Consumer awareness sessions (both online and offline) were conducted to educate consumers about schemes and on the usage of energy-efficient appliances and their benefits
> Rebate-based scheme is approved by the regulatory commission where rebate is calculated on an empirical formula given by the regulatory commission, based on energy savings and compressor warranty
> Local citizens from Delhi were reached out to. The empanelled vendors would contact the registered consumers in two days to confirm registration and share payment details
> Vendors install AC at consumer premises once the consumer completes payment. Online mode of payment is also available

Monitoring, Evaluation, and Management

Energy savings were calculated based on energy consumption before and after installation of AC under the scheme through AC OEM under the warranty period.

> Annual savings at the consumer end are estimated at 6.81MUs (mega units)
> Annual savings at distribution companies was estimated to be 7.36MUs
> The estimated reduction in peak load was approximated at 7.56 MWs (megawatts)

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 43 million

Who can help?

UNEP, DERC

Why care?

Uptake of energy-efficient appliances and reduction of GHG emissions

Impact

> 8,732 energy-inefficient ACs replaced with BEE five-star rated energy-efficient ACs
> The total reduction in tCO2 (tonnes of CO2) at the DISCOM periphery was estimated to be at 5966 tCO2
> The total saving potential from the replacement of old and inefficient air conditioners with energy-efficient ACs is 156.75 MUs (mega units) which is 264.50 MWs (megawatts) of saving in demand

Replacing old working energy inefficient ACs under BRPL Scheme
Source: Financial express Reuters

Inadequacies and Learnings

> The time taken from purchase to installation of AC is higher than usual time. It should be within 24 hours
> Stock availability must be ensured since more than 44 percent of air conditioners are old technology appliances
> In such business models, the fluctuating demand-supply gaps could be a risk associated with continuing to provide the 40 percent discount on each AC

Scalability

The India Cooling Action Plan provided the estimated rapid AC demand in the Indian market. The project has great potential for scalability in other cities and expanding the scope and magnitude as well.

DISCOMs in partnership with manufacturers, can develop business models that replicate success that leads to monetary benefits for consumers and reduces grid stress and transmission and distribution losses. Reduced transmission and distribution loss would enable DISCOMs to improve their balance sheet.

Since demand aggregation is key to the success of such programs, municipalities can partner with electric utilities to develop a programme to replace inefficient cooling equipment in municipal/public buildings. This would enable savings on energy bills and utilise saved funds for other activities.

Challenges Addressed

> Working towards mandating the replacement of old non-star rated ACs with energy efficient ACs for all commercial and industrial consumers, including all types of institutions (both public and private) and hospitals
> Aiming for affordability of energy-efficient appliances in comparison to other appliances through tax incentives
> Creating consumer awareness of energy-efficient appliances

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

14

Benchmarking Energy Performances

Kochi, Kerala

Timeline: *2019 onwards, 6 to 12 months*

Location: *Kochi, Kerala*

Scale: *City scale*

Funding Agency: *Building Efficiency Accelerator*

Policies/Schemes/Plans: *Kochi Municipal Corporation in collaboration with Building Efficiency Accelerator*

Agencies: *WRI India, Centre for Heritage Environment and Development (c-hed) and Kochi Municipal Corporation (KMC)*

Project Cost: *Not Specified*

Alliance Partners: *WRI*

About the Project

The study aimed to develop a methodology for city-wide energy benchmarking exercises in India. Energy performance benchmarking helps establish the baseline energy performance of existing buildings. With support from the Kochi Municipal Corporation and the Centre for Heritage Environment and Development (c-hed), WRI India benchmarked 50 office spaces as per their energy performance. The buildings and construction sector accounted for 36 percent of global energy use and 39 percent of energy and process-related carbon dioxide (CO_2) emissions in 2018.

In India, buildings were responsible for 33 percent of total electricity consumption in 2018 to 2019 with more than 60 percent of India's electricity needs coming from thermal power. Globally, countries are committing to de-carbonising their building stock. The project received technical support from WRI in achieving de-carbonisation targets, since it requires an understanding of the efficiency levels of existing buildings.

Objectives

The core objectives were focused on the following:

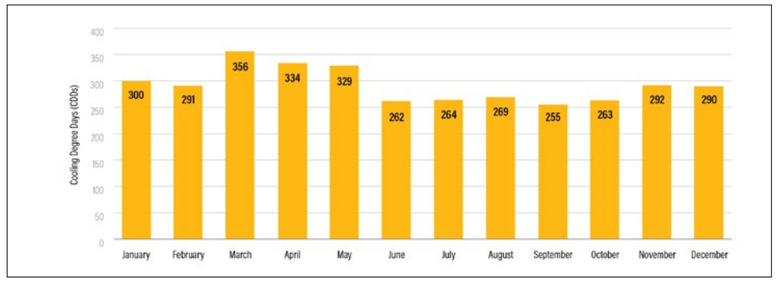
> Assessing the feasibility of conducting a citywide benchmarking exercise for office buildings
> Developing Building Performance Indices (BPIs) for the offices
> Documenting barriers to implementing retrofits for different owner-tenant models and enablers to seek energy efficiency services

Project Implementation

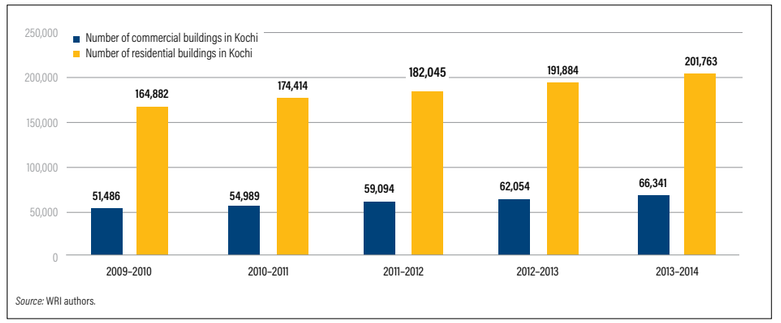
> A survey was conducted to collect data from 50 selected offices
> Following this, qualitative research was conducted to understand the perspective of buildings' owners/management towards energy retrofits and energy efficiency services
> The collected data was closely analysed using statistical tools to benchmark them based on their energy performance
> Different parameters, including total floor area, conditioned area, occupancy density etc., were considered to assess their influence over the performance of these buildings
> Later, these buildings were benchmarked and informed about their performance

Monitoring, Evaluation, and Management

Offices were chosen because they account for 27 percent of large commercial consumers in Kochi, the second largest category after retail spaces. Also, office spaces are more amenable to the initial landscape assessment due to more typical operational hours and building design. Large commercial consumers were defined as those with connected load above 75 kilowatts (kW) or contract demand over 100 kilovolt amperes (kVA). Threshold determination was based on data for buildings within the Energy Conservation Building Code (ECBC).



Number of cooling degree days in Kochi



Commercial and residential buildings added to Kochi's building stock

Inadequacies and Learnings

The study is a first-of-its-kind effort done in India at the city scale. There were limitations imposed by the relatively small sample and the challenges posed by the sample not being representative. The project would have been more effective had it collected more data, particularly on variables such as building orientation, equipment schedule, envelope characteristics, indoor environment quality, and thermal comfort.

Scalability

While this project only considered 50 offices in the city, this could be scaled up to cover multiple building typologies and a more significant number of buildings. The project could be implemented across the different cities and states in the country.

Challenges Addressed

> Building managers/owners are unaware of their building's energy performance compared to their peers
> No centralised system exists for any city to track and monitor the energy performance of its buildings to make necessary interventions
> Identified the different barriers to energy retrofits

How much?

Not Specified

Who can help?

WRI India, Kochi Municipal Corporation

Why care?

Setting a city-wide energy benchmarking system

Impact

> The project assessed and compared the energy performance of 50 buildings and shared the details with them
> The building owners/managers are equipped with information of their building's energy performance enabling them to take a call on retrofitting for more efficiency

To know more:

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

15

City Centre District Cooling System

Medellin, Colombia

About the Project

Medellin built the first district cooling system of Colombia, and possibly of Latin America, in its iconic administrative city centre. It includes a district cooling plant that generates power with a gas turbine and uses a combination of absorption and electric vapour compression water chillers using ammonia as a natural refrigerant. All buildings connected to the network were retrofitted to achieve further efficiency. The plant is close to the metropolitan area administration building and was designed to be integrated into an urban environment.

Objectives

This project is designed with the objective to:

> Promote energy efficiency
> Phase-out the use of remaining ozone-depleting (OD) and high global warming potential (GWP) substances
> Achieve economic gains through district cooling
> Include capacity-building components that incorporate technical, financial, and regulatory assistance

Project Implementation

Before implementing the Alpujarra DC system, the Empresas Públicas de Medellín (EPM) group built institutional capacity for implementing district cooling in smaller scale projects. The project, led by the Colombian Government, with the support of the Swiss Government, has been built and operated by EPM, the municipal utility company and one of the largest companies of the country. It delivers chilled water to seven public buildings through a network of about three km of piping. The production centre houses a power plant of one megawatt (MW), natural gas regulator, electrical substation of two MW, absorption chiller, a battery of compressor chillers and cooling towers.

Monitoring, Evaluation, and Management

> EPM is undertaking all the operational risks. This is especially important in a district cooling system that uses ammonia as a refrigerant. Ammonia is highly explosive and requires strong safety measures
> EPM is also risking delays or cost overruns in the construction phase. The initial estimated cost was increased between 20 to 30 percent because of depreciation of the Colombian Peso

Timeline: *Since 2016, Phase 1 - 2013 to 2019*

Location: *La Alpujarra, Medellin, Colombia*

Scale: *City scale*

Funding Agency: *Colombian Government*

Policies/Schemes/Plans: *District energy, local and national policy frameworks under development by the Ministry of Environment: 'Distritos Térmicos Fase I' and 'Distritos Térmicos Fase II'*

Agencies: *Empresas Públicas de Medellín (EPM) Group, Economic Affairs Secretariat of Switzerland (SECO), the Ozone Technical Unit (UTO), and the Climate Change and Risk Management Directorate of the Ministry of Environment and Sustainable Development of Colombia*

Project Cost: *INR 620-750 million (USD 10 -12 million)*

Alliance Partners: *UNEP*

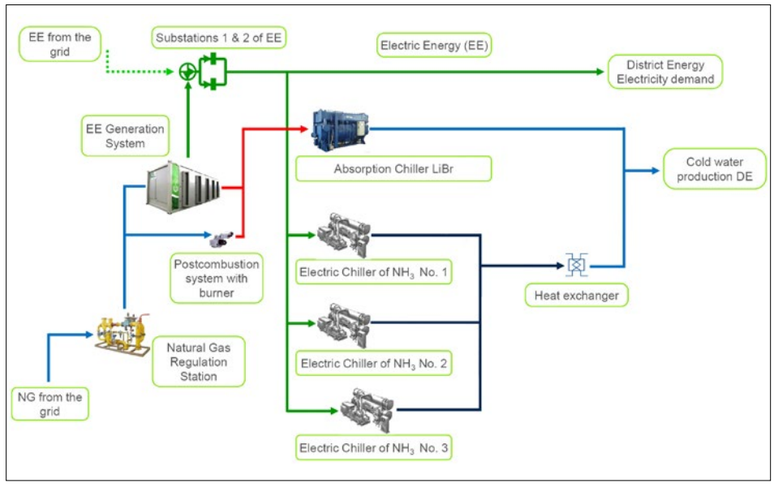


Diagram depicting La Alpujarra district cooling system

Inadequacies and Learnings

> Urban redevelopment projects take a long time to implement in Colombia. Hence, project cash flows take longer to materialise and need to be discounted for considerable periods, further reducing the discounted net cash flow of potential projects
> It was also important to factor in the risk of an unexpected variation of the exchange rate that may jeopardise the financial stability of the project

Scalability

The district cooling plan was designed with enough capacity to connect additional buildings in the city centre. A university and office building have recently been connected, and the utility has plans to continue extending the network.

Challenges Addressed

> The project targets the challenge of poor air quality
> It also addresses the concern of low energy efficiency of cooling systems
> Concentration of high global warming potential (GWP) and of harmful ozone-depleting (OD) elements from individual cooling systems

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 620-750 million

Who can help?

UNEP

Why care?

Reducing 1,200 tonnes of CO2 (equivalent to 235 vehicles driven for a year), decreasing emissions by 30 percent

Impact

> Commitment and coordination of local, national authorities, and international donors
> Strong relationships with potential clients. Empresas Públicas de Medellín (EPM) leveraged its position as a public company and secured official buildings as long-term clients
> Eliminates 100 percent of substances that deplete the ozone layer.
> The energy consumption reduced was equivalent to the energy consumed by 220 homes annually

16

City-led Energy Efficient District Cooling System

Gandhinagar, Gujarat

Timeline: *2015 onwards*

Location: *GIFT city, Gujarat*

Scale: *City scale*

Funding Agency: *Initial funding from consortium of banks subsequently from revenue generated and equity*

Agencies: Gujarat *State Government, Real Estate Developer, District Cooling Developer, SEZ agency*

Project Cost: *INR 17.36 billion (USD 280 million), with Phase-1 of project cost - INR 1.12 billion (USD 18 million)*

Alliance Partners: *UNEP*

About the Project

District Cooling System (DCS) is a proven and widely adopted cooling technology for providing air conditioning from centralised cooling plants to multiple commercial and residential buildings in a densely populated area of the city. The DCS system has unparallel savings in terms of power consumption, reduced carbon emissions and many other environmental and economic benefits for the developer, user and society.

The GIFT city was the first city in India to adopt DCS. It has a total requirement of 270,000 TR of air-conditioning, but by adopting the DCS, this will be just 180,000 TR comprising chillers and thermal energy storage tanks. The city has planned three DCS plants of 60,000 TR (tonnes of refrigeration) each such that the distribution network can be optimised and interconnected to provide the highest reliability and redundancy. Each plant is designed with a chilled water-based stratified thermal energy storage tank, which can be charged during the off-peak period and discharged during the peak, thus reducing the electrical demand from 240 MW to 135 MW.

DCS at GIFT can be a showcase example of planning, developing, establishing, operating and maintaining cooling as a utility service for many large-scale upcoming smart cities in the country. Such quality and magnitude of infrastructure are being implemented for the first time in the country. Due to its key benefits, DCS has a significant environmental, social, and economic impact on developers, users, and society.

Project Implementation

The city has planned three DCS plants of 60,000 TR each to optimise the distribution network. The first phase of the 10,000 TR plant, 10,000 Tr-Hr TES tank and approximately 5,000 m of pre-insulated piping network is implemented connecting to 12 consumer buildings. This DCS system has been in operation since 2015 and is successfully running without interruption. Various expert consultants and EPC contractor services were associated with the entire project development cycle of the DCS system.

Energy efficient proven cooling technology implemented for the first time in India for a green field city level development. The local technical staffs had little know-how on design, operation and maintenance and optimizing the operations of such systems. But the international district cooling developers provided the trainings and hand-holding support.

District Cooling System, a widely adopted cooling technology

Inadequacies and Learnings

Availability of adequate DCS load in the initial start-up period. TES tanks and smaller-size pumps can be adopted to overcome initial low-load conditions.

Monitoring, Evaluation, and Management

The centralised control room monitors, controls, and safeguards all the operations using Supervisory Control and Data Acquisition (SCADA). 24x7 monitoring of processes and maintenance through dedicated expert agencies through the central command centre. Specialist O&M agency works on achieving critical Key Performance Indicators (KPI) of plant performance such as committed supply temperatures, Plant power and water consumption, water quality, automatic chemical dosing, equipment health monitoring etc.

Scalability

DCS technology must be viewed as a solution for the increase in atmospheric temperature in urban areas and promoted and adopted for large-scale projects. The installation at GIFT City will go a long way towards inspiring the adoption of this technology by large-scale mixed-use developments in other cities.

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 17.36 billion

Who can help?

UNEP, Gujarat State Government

Why care?

Electricity demand reduced from 240 MW to 135 MW

Impact

- High-efficiency system for lower energy consumption and lower carbon emissions
- High diversity and reliability
- Reduced space requirement as well as noise and vibration at a building level
- Lower operational and maintenance costs for the centralised facility
- Lower electrical demand for individual building
- Lower usage cost for the end user

17

Cool Roof for Inclusive Communities

Rajasthan and Gujarat

Timeline: *2021 to 2022*

Location: *Pilots in several cities and villages in India*

Scale: *Site scale*

Funding Agency: *Demonstration projects by SEWA and Mahila Housing Trust (MHT)*

Agencies: *Natural Resources Defense Council (NRDC), Mahila Housing Trust (MHT), Self Employed Women's Association (SEWA)*

Project Cost: *Solar reflective paint at INR 1,000 to 2,500 to cover 9.2 sq. m of the roof with two coats*

Alliance Partners: *UNEP*

About the Project

The Hariyali Green Villages initiative aims to enhance the accessibility and affordability of clean energy technologies and improve livelihood opportunities at the household level in rural India. Beyond air conditioning, Indian cities are implementing various measures through Heat Action Plans to help cope with extreme heat, including providing public drinking water stations and cooling centres and implementing low-cost, passive land cover adaptation strategies such as cool roofs and urban greening. Cool roofs are a successful climate change adaptation solution, especially for poor and vulnerable communities that have limited access to cooling appliances, as well as limited financial resources. They help by reflecting some of the sun's incoming radiation to the atmosphere, reducing building heat retention and the need to cool indoor spaces. They can keep indoor temperatures 1.5 to 5°C (2.7 to 9°F) lower than conventional roofs. While more advanced cool roofs can be expensive, affordable cool roof solutions such as solar reflective paint are cost-effective.

Objectives

> Heat stress for the people unable to afford air conditioners
> Reducing power usage for cooling which impacts air pollution and climate change
> Need for early adoption of clean energy technologies to reduce planet-warming emissions
> Growing country-wide cooling demand

Project Implementation

NRDC, MHT and SEWA have piloted cool roofs using solar reflective paint. Training sessions on applying solar reflective paint were organised, along with cool roof demonstrations to empower rural women.

Inadequacies and Learnings

Create awareness for vulnerable communities; organise stakeholder consultations; engage with policymakers and create positive discourse; scale cool roof implementation before heat season for maximum impact.

Monitoring, Evaluation, and Management

Cool roof households can report improved thermal comfort and energy bill savings.

Solar reflective paint on the roof keeps indoor temperatures 1.5 to 5°C lower than conventional roofs

Training session on the application of the paint on the roof

Scalability

NRDC and partners have been working to advance clean energy access and environment-friendly solutions through the Hariyali Green Villages initiative. They plan to scale it up to at least a hundred villages by 2025. NRDC and partners will continue working with stakeholders to implement and scale women-led climate solutions in all parts of India.

To know more:

- Urban Planning, Green Cover and Biodiversity
- Energy and Green Buildings
- Mobility and Air
- Water Management
- Waste Management

How much?

INR 1,000 to 2,500 per 9.2 sq. m

Who can help?

UNEP

Why care?

Reduces indoor temperature up to 5°C

Impact

> Pilots in Jodhpur, Bhopal, Surat, and Ahmedabad have covered more than 460 roofs and reached 13,587 households and 67,935 individuals with information on solar reflective paint

- *Innovation*
- *Technology/ E-Governance Intervention*
- *Capacity Building*
- *Community Involvement*
- *Gender Inclusion*
- *Behavioural Change*

18

Deploying Efficient Air Conditioning

Delhi, Noida and Mumbai

Timeline: *3 to 6 months*

Location: *Delhi; Noida, Uttar Pradesh; and Mumbai, Maharashtra*

Scale: *City scale*

Funding Agency: *Global Environment Facility-6 (GEF-6)*

Policies/Schemes/Plans: *Energy Conservation Act*

Agencies: *Energy Efficiency Services Ltd. (EESL), Housing Development Finance Corporation (HDFC) Bank, United Nations Environment Programme (UNEP), Asian Development Bank, Voltas*

Project Cost: *INR 1.6 million (USD 25,600)*

Alliance Partners: *UNEP*

About the Project

The project focuses on adopting energy-efficient Refrigeration and Air Conditioning (RACs) using HDFC bank ATMs as demonstration sites. The ATMs were used as a case study to showcase actual savings in terms of money and operation and maintenance (O&M) costs. The aim was to promote super efficient air conditioners (SEAC) and behavioural change in shifting preference towards five-star SEAC. 10 ATMs in the three cities were targeted as pilot projects. Site selections were based on criteria such as climatic conditions, geographic variations and usage patterns. After successful demonstration of the pilot projects, HDFC bank scaled up its ACs at all ATMs and around 7,000 branches in India.

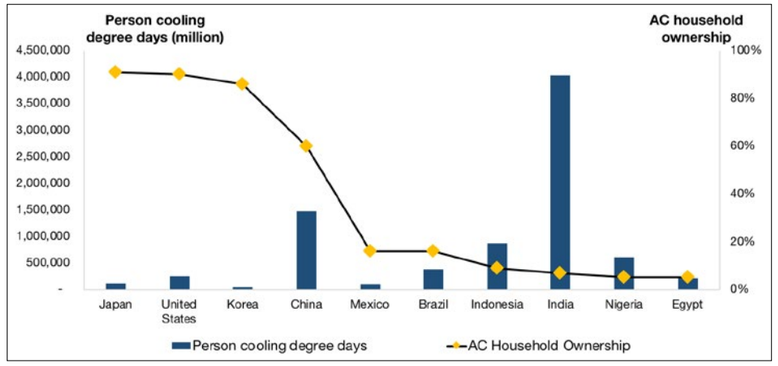
Project Implementation

The funds procured from Global Environment Facility-6 (GEF-6) were utilised for technical assistance, the roll-out of the programme and the setting up of a revolving fund for further scaling up.

A robust roll-out mechanism was developed in consultation with UNEP, ADB, original equipment manufacturers (OEMs), experts, recyclers, banks and other financing institutions. The initial target was retail customers, and later the programme was extended to institutional customers such as National Thermal Power Corporation Limited (NTPC), HDFC bank, and several others.

Specification preparation and stakeholder consultation with OEMs, experts, and others were used to prepare the groundwork. Tender for bulk procurement and implementation took around six months. This requires the preparation of technical specifications, quality and cost-based selection (QCBS), buy-back, safe disposal, financial mechanism and model for this switch.

A large national-level campaign was launched on TV, radio and social media to promote SEAC, low cost EMI, special schemes and the website for centralised order tracking and fulfilment. Special discounts for females, weekend offers and employee schemes were also undertaken. Festival offers were launched from time to time. A dedicated customer care was set up to resolve complaints and grievances.



Cooling demand versus current AC ownership in different parts of the world

Standards set by EESL for super efficient room air conditioner deployment

Monitoring, Evaluation, and Management

> Created an online dashboard for deployment of SEAC
> Buy-back opportunity of old Refrigeration and Air Conditioning (RACs)
> Safe recycling of refrigeration waste
> OEM monitored through an online monitoring tool

Inadequacies and Learnings

> The programme faced many challenges due to COVID-19, which took away the prime time for gathering momentum
> Competitive prices from other players were a major inhibiting factor for SEAC deployment
> Customers have specific preferences for demand, type of AC, brand and appearance. Retail customers prefer low initial costs over energy efficiency

Scalability

The overall potential for five-star super efficient RACs is around 85 percent of the market share in India.

Challenges Addressed

> Peak power demand mitigation and energy security
> Emission reduction and climate-friendly refrigerant with safe disposal

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Gender Inclusion

Behavioural Change

How much?

INR 1.6 million

Who can help?

UNEP

Why care?

Energy savings from the pilot project was 31.6 percent

Impact

> Reduction in energy consumption and peak demand reductions were major impacts addressed by the project
> The project considered the mitigation of Ozone Depletion Potential (ODP) and Global Warming Potential (GWP)

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

19

Developing Climate-Neutral Townships

Pune, Maharashtra

Timeline: *2021 to 2022*

Location: *Pune, Maharashtra*

Scale: *Site scale*

Funding Agency: *Shakti Sustainable Energy Foundation, REPIC Switzerland*

Agencies: *2000-Watt Smart Cities Association, Nuesch Development India*

Project Cost: *Technical Assistance at INR 14.5 million (USD 196,109); Project Implementation Cost at INR 28.6 million (USD 387,709)*

Alliance Partners: *2000-Watt Smart Cities Association*

About the Project

Symbiosis International University in Pune has around 350 acres, with about 9500 students and eight faculties. The campus is certified under the 2000-Watt Smart Cities (WSC) India rating system which aims to optimise the entire campus regarding energy efficiency, reduction of Green House Gases (GHG emissions), and high quality of life. The project analysed the areas of energy consumption and supply, new buildings in terms of their operational and embodied energy, mobility induced by the campus (the campus currently has restrictive use of private motor vehicles), water, food provision and waste. Following the broad vision focusing on developing a 'Green Campus', the SIU 'Green Campus Policy' affirms its commitment to recognising environment and sustainability.

Objectives

> Environmental Impact Assessment tool is used to identify the environmental, social and economic impacts of a project prior to decision-making
> Energy Conservation Building Code objective is to establish minimum requirements for energy efficient design and construction of buildings
> India Cooling Action Plan seeks to reduce cooling refrigerant demand, cooling energy requirements and recognise cooling and related areas

Project Implementation

The overall project was implemented through the following process:

> Data collection for operational energy through evaluation of building stock, mapping campus energy use and embodied energy for new construction
> Action workshops for the development of smart solutions and the action plan for the transformation phase
> Organising the Building Energy Efficiency Project (BEEP) design charette for the optimisation of the student hostel and academic blocks
> Development of operation energy optimisation plan
> Getting relevant certificates
> Development of an Indian criteria catalogue and management tool (V2.0) that will suit the local culture and attitudes
> Reduce consumption of electricity by monitoring, automation and using appropriate signage
> Metered electricity use in the hostels with any excess energy consumption should be charged at a higher rate
> Pooling of transport and car sharing by students and staff
> Use of e-vehicles/bicycles within the campus
> Minimum wastage of cooked food through appropriate signage's/display boards and short video clips

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 14.5 million

Who can help?

2000-Watt Smart Cities Association

Why care?

The plant has reduced 694 tonnes of CO_2 equivalent emissions

Impact

> This project has seen remarkable success through the integrated design process and system thinking approach
> The overall process of developing practical master planning strategies to reduce GHG emissions was highly collaborative
> Improving the quality and well-being of students and staff on campus. The SIU campus will become climate-neutral in the next 20 years

Symbiosis International University campus

Monitoring, Evaluation, and Management

SIU campus being a 2000WSC transformation project, goes for periodical monitoring in terms of an annual meeting held every alternate year to ensure all the strategies listed are implemented with focus on the next phase execution. With these yearly meetings and the system's implementation, the campus re-certification aligns with the roadmap developed. Re-certification looks at the compliance of qualitative and quantitative scores as per the committed roadmap. SIU campus is driven towards climate neutrality. This includes various activities under the operation and maintenance framework. They are:

> Integration of building and energy management systems for the buildings on campus
> Ensuring all lights and fans are switched off when not in use
> Ensuing peak electricity shifts to avoid blackouts

Scalability

2000 WSC label has a vast scope in the Indian market. This label can be executed for different scales of built-environment projects such as township level, campus level, city level, regional level etc.

Challenges Addressed

> Development of climate-neutrality roadmap for the campus
> Effective decision making through stakeholders' consensus building
> Mapping performance benchmark for water, waste, air quality, food sourcing and consumption

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

20

District Cooling System for Citizens

Cyberjaya, Malaysia

Timeline: *1998 to 2012*

Location: *Cyberjaya, Malaysia*

Scale: *City scale*

Funding Agency: *Central Ministry of Finance, Malaysia*

Agencies: *Cyberview Sdn Bhd, ENGIE Services Malaysia Sdn Bhd, Pendinginan Megajana Sdn Bhd*

Project Cost: *INR 2.25 billion (USD 50 million)*

Alliance Partners: *UNEP*

About the Project

The project focuses on incorporating a district cooling system as a medium for energy demand management and cost savings strategy. The city of Cyberjaya made it mandatory for consumers to connect to the district cooling system and not install any air conditioners in buildings. Located about 50 km south of Kuala Lumpur, Cyberjaya implemented district cooling in 1998. It commissioned a local energy service company, Pendinginan Megajana Sdn Bhd, under a build-own-operate concession, where equipment ownership remains with the company. A 30-year concession contract was developed by the city and delivered by Pendinginan Megajana Sdn Bhd. ENGIE brought in finance as well as more operational experience to the company.

Objectives

The system comprises two district cooling plants with a total chiller capacity of 22,000 refrigerant tonnes (RT), built in two stages between 1998 and 2012. It was complemented by 970,500 RT thermal storage and a closed loop underground network of 15 km of pipeline. The system serves 48 large customer buildings in Cyberjaya.

Project Implementation

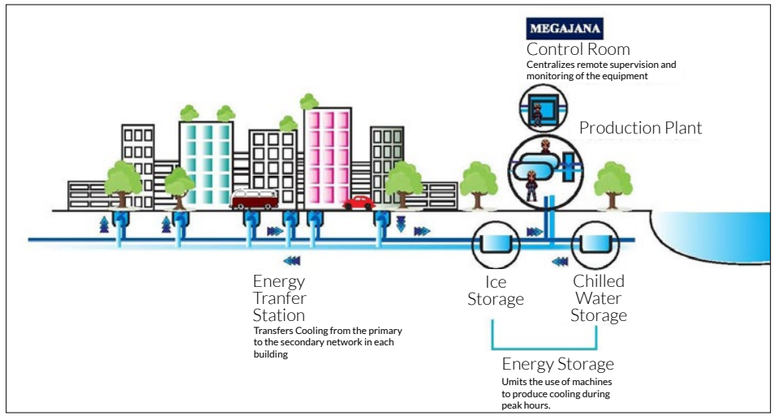
Thermal storage for demand-side management enabled the production of chilled water and ice at reduced costs during the evening, taking advantage of the night-time tariff (which is less than half of the peak-time tariff). This form of demand-side management benefits Cyberjaya, its end-user customers, and the power utility.

Monitoring, Evaluation, and Management

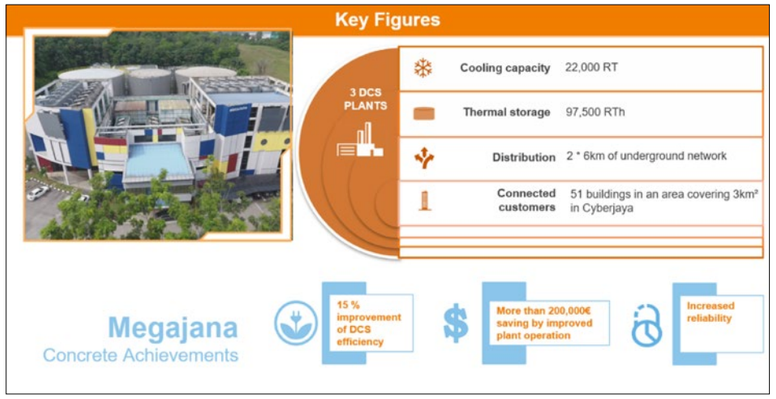
The control room monitors, controls, and safeguards all the operations using the Supervisory Control and Data Acquisition (SCADA) system.

Inadequacies and Learnings

- No specific body to regulate the development of district energy
- Lack of awareness about district cooling systems' benefits
- Lack of funding for early-stage assessments of projects
- Lack of innovative business models
- In Malaysia, Chilled Water (CHW) tariff is unregulated, hence there is a need for customised tariff to match development scheme and customer type
- High service level expectation from customers such as developers, owners and end users, lead to tedious & long process for convincing various stakeholders



Diagrammatic representation of district cooling system process



Key features of the Cyberjaya District Cooling System

Scalability

Over the past 20 years, Malaysia has installed 11 DCS with a capacity of 190,000 tonnes of refrigeration (TOR) [667 megawatts (MW)]. According to a report by ADB, Malaysia could triple the scale of its DC industry to a built-up capacity of 575,000 TOR, the equivalent cooling load of up to 12 million sq. m of commercial floor space. With the pace of Malaysia's real estate market growth, and the numerous successful DCS being commissioned across the country, this potential is even higher.

Challenges Addressed

- Malaysia is facing rising electricity demands for air conditioning, which accounts for 30 to 50 percent of energy demand from buildings nationwide
- It is estimated that 60 percent of a regular office's utility bill goes to air conditioning alone, and for data centres, this can reach 80 percent
- The district cooling project has led to annual cost savings of 39 percent compared to business-as-usual and has reduced Cyberjaya city's peak electricity load by 3 MW, helping to tackle the growing air conditioning demand in Malaysia

How much?

INR 2.25 billion

Who can help?

Central Malaysia Ministry

Why care?

Annual savings is 39 percent compared to standalone systems

Impact

- The district cooling system reduces energy consumption, lowers the operating costs of buildings and ensures environmental sustainability
- Increased energy demand reliability
- Over the long term, DCS charges are lower than standalone chiller plant long-term and day to day expenditures
- 11.7 percent internal rate of return over 30 years with a payback period of eight years

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

21

Housing Complex District Cooling

Hyderabad, Telangana

Timeline: *3 years*

Location: *Hyderabad, Telangana*

Scale: *Site scale*

Funding Agency: *Private builder/ real estate developer*

Agencies: *Residential housing society, My Home Construction (Real estate developer) and end consumers*

Project Cost: *INR 174 million (USD 2.8 million)*

Alliance Partners: *UNEP*

About the Project

The 'My Home ABRA' district cooling project is one of India's first district cooling systems for residential apartments. It also includes shopping malls, medical and fitness centres. This is a 'Captive District Cooling' project whereby My Home Construction invests in and operates the district cooling system with Synergy Infra Consultants as a designer and consultant. The project area is one million sq. ft. (92,903 sq. m) covering 380 apartment units across five apartment towers with 3,000-5,000 sq. ft. (278.7- 464.5 sq. m) per apartment. It has a district cooling plant of 2,450 tonnes of refrigeration (TR).

Objectives

The district cooling plant is billed with a flat consumption tariff throughout the year with no minimum demand requirements. Thus the electricity tariff is incentivised for district cooling plants. The residential society has integrated energy, water, gas and cooling usage into one single bill with prepaid metering which ensures timely payment.

Project Implementation

The state environment department or the urban development department can make it mandatory for large new township projects to evaluate the option of district cooling at the planning stage. After several consultation and awareness rounds with the stakeholders, few individual flats increased the contract demand and transformer size by 4,200 kilowatts (kW). For district cooling and thermal storage, My Home runs 1,500 TR chillers. These residential apartments are cooled using a concealed indoor fan coil unit instead of ducting, providing a more aesthetic look to the apartments and saving space. The maintenance charges are approximately INR 4,400 per apartment annually, which is relatively lower compared to split air conditioners.

Monitoring, Evaluation, and Management

> Since this was the first district cooling system (DCS plant), it had mechanical metres installed to get the british thermal unit per hour (BTU/hr) and understand the chilled water flow rates, pressures, energy consumption at chiller etc. Due to the abundance of data collected, the company could improve the system efficiency, transformers capacity and cooling appliances efficiency. The system cost is around INR 190 per sq. ft.
> There is a plan now to replace digital metres with Internet of Things (IoT) based communication systems and daily report generation on system performance
> The service contract is made with Heating, Ventilation, Air Conditioning (HVAC) operators. The administrative responsibility is handled by the housing society

Abhra incorporating India's first district cooling systems for residential apartments

> By using thermal storage and benefiting from the 30 percent diversity in the different consumer patterns of using air conditioners, the district cooling system requires 57 to 70 percent less capacity than variable refrigerant volume (VRV) systems or split air conditioners (ACs). This made the cost economics better for district cooling systems (DCS) and convinced the builder to shift from individual purchased split units to community-level district cooling.

Inadequacies and Learnings

> The diversity factor in the residential sector is very high and hence the initial chiller capacity of 2,450 TR can further be reduced by 800TR
> If any apartment goes for renovation, there is a change in the original position of cassette air conditioners which leads to lower chilled water flow or drop in pressures/temperatures leading to inadequate cooling and hence complaints from the apartment owner

Scalability

The potential for scalability is huge. If large builders like DLF, Hiranandani, Raheja, Lodha etc. adopt district cooling in residential township projects at design stage will not only contribute to energy savings but also result in use of environment friendly and low global warming potential (GWP) refrigerants. The project has high replicable potential in many cities in India.

Challenges Addressed

Increasing electricity bills due to increased use of split air conditioners in high end residential society.

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 174 million

Who can help?

UNEP

Why care?

District cooling system requires 57 to 70 percent less capacity than air conditioners

Impact

> Inclusion of district cooling in the construction and design stage of the buildings
> Community participation in ensuring operation and maintenance of projects
> The project saved the capital expenditures (CapEx) in electrical infrastructure such as split air conditioners (around 4,000), transformers, cables, excess contract demand from electrical utility etc. and improved the cooling efficiency with reduction in electricity cost to apartment owners

22

Promoting Clean Energy Air Conditioning

Gandhinagar, Gujarat

Timeline: *August 2017 to February 2018*

Location: *Gandhinagar, Gujarat*

Scale: *Site scale*

Funding Agency: *Ministry of New and Renewable Energy (MNRE), UNDP - GEF*

Policies/Schemes/Plans: *MNRE and UNDP facilitated financial assistance scheme*

Agencies: *Gujarat State Electricity Corporation Limited (GSECL), Gandhinagar Thermal Power Station, Gujarat Energy Research and Management Institute, Gujarat Energy Development Agency (GEDA)*

Project Cost: *INR 45.2 million (USD 729,580)*

Alliance Partners: *UNEP*

About the Project

The project is a good practice for using solar power to support the heating and cooling requirements of a large operational office building in India. The office building in Gandhinagar with an area of 2,000 sq. m needed 1,575 sq. m of solar installations to fill its heating and cooling requirements.

Installed at the Gandhinagar Thermal Power Station (GTPS), the concept was proposed by the Gujarat Energy Research and Management Institute (GERMI) to Gujarat State Electricity Corporation Limited (GSECL). Further, GERMI prepared the detailed project report and tender document, where the Detailed Project Report (DPR) was submitted to MNRE and UNDP for the applicable financial assistance scheme.

Objectives

The project focuses on:

> Combining energy efficiency with technology
> Integrating two backup systems - thermal storage and electrical water heaters
> The use of smart monitoring and control mechanisms using sensors
> Programmable logic controllers (PLC) controllers for environment-friendly air conditioning

Project Implementation

This project uses a solar thermal field comprising 525 solar thermal collectors to provide hot water at 90°C to the vapour absorption machine (VAM). Chilled water from VAM is then circulated through three air handling units (AHU), providing conditioned air to cater to each block. The VAM utilises water as a refrigerant in the system. There are two hot water storage tanks (15,000 litres each). The plate heat exchanger (PHE) was used for winter heating of the office area.

There are more than 80 sensors used, along with weather monitoring (GHI, DHI, DBT, RH) systems. These sensors and variable frequency drives, flow metres, BTU metres, and PLC control panels ensure smooth operations based on logic.

A solar thermal field comprising 525 solar thermal collectors

Monitoring, Evaluation, and Management

> The project consultant (GERMI) was responsible for the quality control of the project installation activities, which consisted of document review, drawing review, approvals, project monitoring meetings and periodic site visits, and commissioning trials
> The tender was prepared such that the comprehensive operation and maintenance (CMC) for 10 years post-commissioning will be the responsibility of the engineering, procurement and construction (EPC), against the annual CMC amount
> Regular plant-related operations and maintenance are carried out by the EPC

Inadequacies and Learnings

> Cooling demand reduces with low solar radiation and increases with higher radiation
> About five to six days in a year require electrical back-up for heating in the monsoon period. This is based on five years of operating experience of the site

Scalability

This concept can be scaled from 30 tonnes of refrigeration (TR) to 1000 TR, as VAM is available within this range. The project site should have sufficient radiation and shadow free area for producing the necessary heat for VAM to produce a cooling effect. The larger plant capacity provides better plant efficiency and commercial viability.

Challenges Addressed

> The solar thermal air conditioning works effectively with both diffused and direct solar radiation
> It offers higher efficiencies and longer service life
> It matches well with the inlet temperature requirement of single effect VAM and offers longer operational hours. The single-effect VAM also offers economic results

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 45.2 million

Who can help?

UNEP, Gujarat State Electricity Corporation Limited (GSECL)

Why care?

Uses solar power to heat and cool a large operational office building

Impact

> It helps phase out CFC, HCFC and other global warming affecting refrigerants used in air conditioning
> Utilises solar energy to consume less than half to one-third the energy compared to conventional air conditioning systems, promoting clean energy adoption policies
> Higher solar radiation will produce more heat, thus producing more cooling. Lower cooling demand can be managed with the available heat

23

Renewable Energy Deployment in Water Supply

Rajkot, Gujarat

Timeline: *June 2018 onwards*

Location: *Rajkot, Gujarat*

Scale: *Site scale*

Funding Agency: *Swiss Agency for Development and Cooperation (SDC) under CapaCITIES project, RMC through the 'SJMMSVY' scheme*

Policies/Schemes/Plans: *Gujarat Solar Power Policy 2015, Swarnim Jayanti Mukhya Mantri Shaheri Vikas Yojana (RMC)*

Agencies: *Swiss Agency for Development and Cooperation (SDC), ICLEI South Asia, Rajkot Municipal Corporation (RMC)*

Project Cost: *INR 8.3 million where INR 4 million for 70kWp solar PV; INR 4.3 million for 75kWp solar PV*

Alliance Partners: *ICLEI South Asia*

About the Project

Rajkot, an industrial town famous for its foundry and machine tools industry, is the fourth largest city in the state of Gujarat. It is located on the banks of the Aji and Nyari rivers at the centre of the peninsular Saurashtra region in the central plains of Gujarat state. The renewable energy deployment project aimed to reduce conventional energy consumption and related Green House Gases (GHG) emission from the water sector.

Out of many water treatment plants, the Aji water treatment plant consumes, on an average, approximately 100,000 units of electricity (kWh) every month. Water supply services of Rajkot Municipal Corporation account for 61 percent of the total municipal electricity consumption (FY 2021-22) at 51.66 million units per annum, leading to the generation of 42,505 tCo2e [tonnes (t) of carbon dioxide (CO2) equivalent (e)] emissions. This amounts to 3,300 units per day or 1.2 million units per year, which is about 3 percent of total electricity consumption in water supply sector.

Project Implementation

The project installed a 145 kWp grid-connected solar photo voltaic (PV) system. The system generates 460 units of electricity per day (170,000 units of electricity per year), equivalent to 14 percent of the total power consumption in the plant. It has reduced 174 tonnes of CO2 equivalent GHG emissions per year from the reduced use of conventional energy.

Inadequacies and Learnings

Integration of Solar PV in municipal services help Urban Local Bodies (ULB) reduce the city-wide GHG emissions and hence, reduce the energy bills.

Monitoring, Evaluation, and Management

A site-specific monitoring reporting and verification (MRV) framework has been prepared, which captures information related to monthly renewable electricity generation and utilization at the plant. To achieve maximum efficiency of the plant, it requires regular cleaning of the Solar PV modules.

145kWp grid-connected Solar PV system as part of the project

Scalability

The successful implementation and learning gave confidence to the ULB to implement similar projects in other municipal services. RMC has already installed a 250 kWp grid-connected solar PV at Raiyadhar wastewater treatment.

A bankable project of 10 mWp captive solar PV based on the RESCO model is also developed under CapaCITIES phase II and submitted to RMC. RMC has proposed a total 4 MWp captive solar PV for consumption in water and sewage treatment plants and pumping stations in the municipal budget.

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 8.3 million

Who can help?

ICLEI South Asia

Why care?

The plant has reduced 694 tonnes of CO2 equivalent emissions

Impact

- The plant has generated 680,000 kWh of electricity since its installation from July 2018 to June 2022
- The dependency of water treatment plant on grid based conventional electricity supply has been reduced through integration of Solar PV
- GHG emission from municipal services i.e. water supply, has been reduced

24

Unique Building Design for Passive Cooling

Bhubaneswar, Odisha

Timeline: *2013 to 2018*

Location: *Bhubaneswar, Odisha*

Scale: *Site scale*

Funding Agency: *State Government of Odisha - Department of Agriculture and Farmers' Empowerment*

Agencies: *State Government of Odisha - Department of Agriculture and Farmers' Empowerment*

Project Cost: *Approximately INR 700 million*

Alliance Partners: *UNEP*

About the Project

Krushi Bhawan is a government facility which houses administrative offices of the agriculture and farmers' empowerment. The building's design is a blend of handlooms, handicrafts and agriculture - the three traditional livelihoods of Odisha. It transcends the typical, closed-off office campus morphology by integrating governmental functions with direct community engagement and education.

Project Implementation

Spatial planning - The ground floor opens into a plaza. The terrace houses urban farming exhibits and crop samples to educate the local populace. The purely administrative spaces are placed on the first, second and third floors.

Social inclusion - The buildings depict local mythologies and agricultural deities in the form of drawings from the ancient temple architecture of the region. Hand-crafted stone lattices in locally-available Khondalite stone, crafted in floral motifs adapted from regional arts are expressed as decorative overlays.

Passive cooling strategy - The courtyard morphology and the inclusion of a stilt level aid optimal air circulation through the building. The staggered building profile enables self-shading. It has a garden with a pond that naturally cools the space, thus reducing energy consumption. Also, there is a demonstration garden that highlights the use of irrigation channels, rainwater harvesting, soil remediation and organic agricultural practices to improve crop yields.

Lowered carbon footprint - Usage of locally sourced materials, including laterite, khondalite stones and clay bricks, along with on site assemblage reduced the embodied energy of the building and energy consumed on the construction site.

Facade strategy - Inspired by the local context, Ikat weaving patterns of Odisha handlooms, the brick facade was created using clay in three different colours to represent the region's geographical diversity. The double-skin facade reduces incident solar radiation by up to 80 percent and cuts direct glare. Low window-to-wall ratio (WWR) coupled with Double Glazing Units (DGU) on all external fenestration, louvres, and sill projections along the facade act as shading devices.

The built mass asserts a unique visual identity with a distinctive brick facade inspired by Ikat patterns

Monitoring, Evaluation, and Management

The monitored energy consumption of the building, including diesel and electricity, based on annual energy bills, yields an Environmental Performance Index (EPI) of less than 35 kWh/m2/y (as per the last calculations performed by studying the energy bills for the year 2018 to 2019, till September 2019).

Challenges Addressed

- Design and development of a thermally comfortable, naturally ventilated office premises in the warm-humid climate zone in India
- Creation of a locally-inspired design language for architectural aesthetics in the south-eastern region. The adaptation of the local ikat textile weaving form in an urban context, posed a great risk for the client-agency. The design and consulting team had to sign an undertaking for the effectiveness of the low-energy cooling system and take responsibility for the functioning of the same
- Implementation of the adaptive thermal comfort approach of the National Building Code, 2005, in combination with suggestions and recommendations of the GRIHA framework

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

Approx INR 700 million

Who can help?

UNEP, State Government of Odisha

Why care?

Special facade helped reduce 80 percent incident solar radiation

Impact

- The complex brings the local rural population and demonstrates how the government can be the prime facilitator of patronage for regional crafts and sustain the communities and economies built around them
- Breaking away from extensive use of glass to represent 'modernisation' or 'the contemporary' and the conventional approach of 'HVAC first' to provide thermal comfort. Air conditioners installed in only 20 percent of the area
- All the waste water generated is reused and recycled

25

Creating Bicycle Friendly Cities

Bengaluru, Karnataka

Timeline: *2020 to 2021, 8 months*

Location: *Bengaluru, Karnataka*

Scale: *City scale*

Funding Agency: *State funding - Directorate of Urban Land Transport (DULT)*

Agencies: *Directorate of Urban Land Transport, Bengaluru, WRI India*

Project Cost: *INR 1.08 million (USD 15,000)*

Alliance Partners: *WRI India*

About the Project

The pop-up cycle lane project creates safer cycle routes. The project involved dedicated cycle lanes, reconfiguring junctions for safe cycling and pedestrian crossings, using semi-permanent yet durable materials like thermostat paint and bollards, and cleaning and re-surfacing the street with an asphalt layer. This project inspired setting up of permanent bicycle lanes in the city of Bengaluru. The pop-up cycle lane stretches 34 km along the Outer Ring Road in the service lane, one of Bengaluru's most traffic-congested roads. Over 1,000 cyclists currently use the Outer Ring Road as a part of their daily commute to the numerous offices and tech parks. The road was a prime candidate for cycling infrastructure to reduce motorist accidents.

Project Implementation

WRI, the Bicycle Mayor, and ambassadors on bicycles inspected the entire stretch to understand the issues a commuter on the ground could face. The team analysed road surface conditions and assessed the distance for safety issues, potential conflict points with vehicles, road visibility conditions, and any obstructions in the lane. Based on the findings and analysis, the cycle track design and alignment were charted using markings with thermostat paint, bollards and signage.

Inadequacies and Learnings

> Permissions took a long time that further reflected in the piecemeal implementation approach, diluting the project's impact
> The lack of signage and markings led to confusion for other users, particularly auto-rickshaws and two-wheelers

Success Factors

The success of the pop-up lane provided an opportunity to develop permanent cycle infrastructure in the Central Business District (CBD) under the Smart Cities Mission. It included identifying an existing informal cycling network within the CBD and developing five model streets with dedicated pedestrian and cycling infrastructure.

Monitoring, Evaluation, and Management

There was constant monitoring of the translation of design by resolving challenges on the ground. The city traffic police and the local corporation continue to maintain and repair the existing cycle tracks, including preventing encroachments, maintaining and repairing bollards, surface treatment, and cleaning of silt.

Current scenario of the streets in the absence of cycle route

A design of the proposed pop-up cycle lane on the service road of ORR

Scalability

The pop-up lane project has created great potential for the city to demonstrate the need for cycle paths as a critical mode of transport that is inclusive of all economic classes. However, there is a need to build visibility and awareness for cyclists and other city stakeholders to help sustain the infrastructure and the cycling culture for a cyclable Bengaluru.

Challenges Addressed

> Type of mobility for safe distancing during the pandemic
> A reliable mode for short distance commutes
> Reducing encroachments due to unplanned parking for two and four-wheelers
> Preventing conflict with motorised two-wheelers and motorcycles entering the cycle lane
> Resolving all dark spots due to poor lighting

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 1.08 million

Who can help?

WRI India

Why care?

34 km bicycle lanes cater to the business district

Impact

> The creation of permanent cycling infrastructure in the Central Business District
> The creation of the city's first cycling committee
> It increased interest and participation in cycling events

26

Cycle Training for Women

Kochi, Kerala

Timeline: *January 2022 onwards*

Location: *Kochi, Kerala*

Scale: *Regional scale*

Funding Agency: *GIZ India*

Policies/Schemes/Plans: *Integrated Sustainable Urban Transport Systems for Smart Cities (SMART-SUT)*

Agencies: *Kochi Municipal Corporation (KMC), Centre for Heritage, Environment and Development (c-hed), Cochin Smart Mission Ltd (CSML)*

Project Cost: *Not Specified*

Alliance Partners: *GIZ India*

About the Project

Cycle training programme for women under the GIZ-supported initiative 'Cycle With Kochi' aims to empower high school girls and women from low-income families with a low-cost and green mobility option for independent commuting.

Kochi Municipal Corporation (KMC), with the support of the Indo-German Green Urban Mobility Partnership (GUMP) project SMART-SUT, has been working on advancing sustainable mobility in Kochi. This included the programme to make Kochi India's cycling capital. The flagship activity under the campaign announced by the Ministry of Housing and Urban Affairs, 'Cycle with Kochi', is the women's cycle training programme aiming at developing the skills of women and high school girls to cycle.

Objectives

The idea was to teach women to cycle and provide them with a low-cost mobility choice. The activity has empowered women to find jobs, be independent and use cycles as their primary mode of mobility. Trainees mostly belonged to lower-income groups and included domestic helpers and fisherwomen who could save the money they spent on public transport commutes. Further, many women enhanced their income as they could travel to more houses and a further distance for work.

Project Implementation

Kochi Municipal Corporation (KMC) called for a bicycle education programme targeting women and high school girls as they have fewer opportunities to learn the skill. GIZ assisted KMC in procuring the bicycles for the training along with technical support for the programme. The on-ground training sessions were conducted across the city, with each ward councillor nominating a ground from their ward. The sessions delivered by women trainees covered cycle riding, maintenance, repair and road safety.

The programme trained over 700 women till August 2022 at eight grounds of Kochi Municipal Corporation (KMC). GIZ facilitated the training by hiring and employing trainers for the eight grounds till August 2022 and provided cycles, safety gear and infrastructure for training. With the concerted efforts from Kudumbashree, a programme of women's self-help groups, and respective ward councillors, beneficiary women were identified to train. The programme also covered the basics of first aid in case of crashes.

Cycle training empowers women with a green mobility option

Scalability

Similar training programmes can be taken up in other cities for various social groups with an aim to encourage them to shift to more environment-friendly modes of transport.

Challenges Addressed

The programme encouraged the adoption of cycling as a sustainable, zero-emission mobility alternative. It provided an opportunity for women, apart from walking to access opportunities. A few of the impact points are mentioned below:

- Over 700 women were trained with mostly belonging to lower-income groups
- A 34 percent shift to cycling among the women trained for daily commute was seen
- 25 percent of unemployed women found employment in the group because they were able to access more opportunities
- 85 percent of the trainees surveyed agreed that commuting to their job had become easier
- 100 percent of the trainees surveyed said they were now confident to travel independently

To know more:

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

Not Specified

Who can help?

GIZ India

Why care?

Reduction of GHG emissions promoting active mobility and gender equality

Impact

- Women were included in the training to support inclusivity, independence, and accessibility
- The training exclusively catered to women and transgenders, pushing gender equality at a city level
- Encouraged the adoption of cycling as a sustainable, zero-emission mobility alternative
- The project supports the reduction of GHG emissions, traffic congestion and promotes active mobility

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Gender Inclusion

Behavioural Change

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Data Tools for Ease in Mobility

Bhubaneswar, Odisha and Trivandrum, Kerala

Timeline: *December 2019 to December 2021*

Location: *Bhubaneswar, Odisha and Trivandrum, Kerala*

Scale: *City scale*

Funding Agency: *GIZ India*

Agencies: *Capital Region Urban Transport (CRUT) for Data Analytics Dashboard, Kerala State Road Transport Corporation (KSRTC) for E-TRAM*

Project Cost: *Not Specified*

Alliance Partners: *GIZ India*

About the Project

Bus agencies across most of the Indian cities still use legacy systems for their day-to-day operations. With the increasing penetration of Intelligent Transport Systems (ITS) technologies in bus transport, the projects, the data analytics dashboard and E-TRAM, attempt to contribute to optimising bus operations using modern-day data analytics techniques and tools.

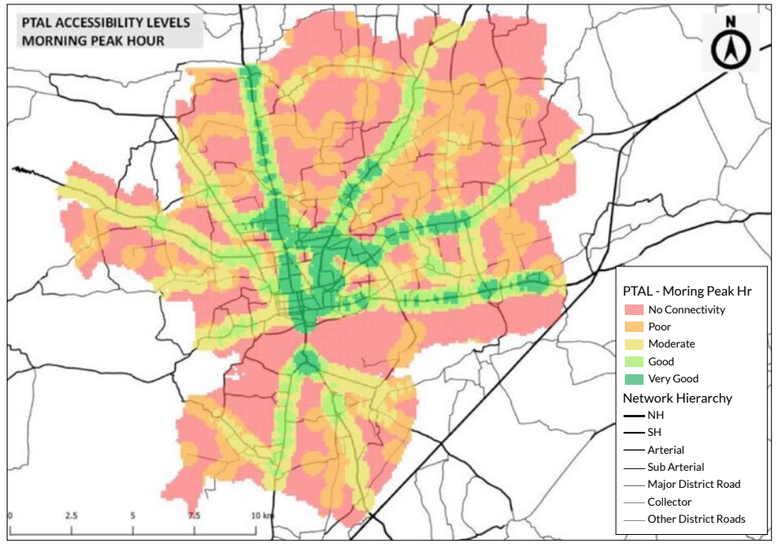
Like many bus operators in Indian cities, the Capital Region Urban Transport (CRUT) in Bhubaneswar has deployed ITS in its operations. ITS deployed in city bus systems are used for improving performance efficiency and service planning methods. The data collected utilises the big data generated through a 'data analytics dashboard'.

On the other hand, based on the recommendations from a route rationalisation study conducted by GIZ in Trivandrum, electronic ticketing machine (ETM) tool for route analysis and monitoring (E-TRAM) has been developed for periodic route performance monitoring.

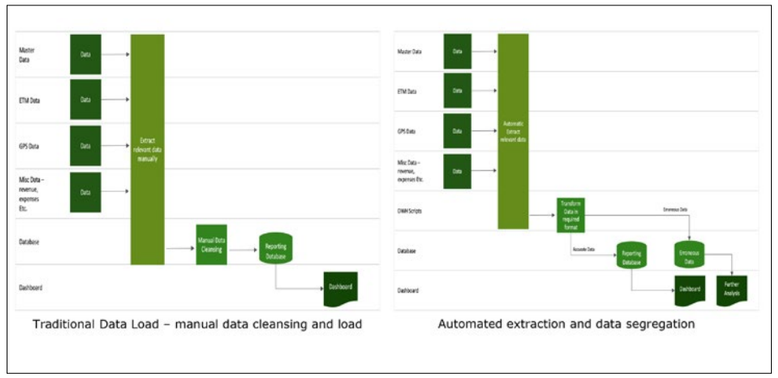
Project Implementation

Data Analytics Dashboard is implemented in Bhubaneswar. The business intelligence (BI) platform was developed to track system performances as per pre-defined Key Performance Indicators (KPIs). This dashboard aimed to develop solutions to the business challenges faced by various stakeholders in bus transport agencies and create a model that enables users to find a solution to their queries. A week-long training programme was conducted for CRUT employees on its utility and application related to their respective organisational functions.

E-TRAM is implemented in Trivandrum. Kerala State Road Transport Corporation (KSRTC) has also been progressive towards initiating data-based decision-making with the help of ETM-based Tool for Route Analysis and Monitoring (E-TRAM) for periodic route performance monitoring. A two-day training was conducted by GIZ for 15 staff members of KSRTC in November 2021 for the application tool in route monitoring and analysis.



Bus route rationalisation for Coimbatore, public transport accessibility levels



Automated data warehouse

Scalability

Though the initial objective was to revamp bus operations in the cities of Bhubaneswar and Trivandrum, both tools could be upscaled to other transit bus agencies. Furthermore, advanced tools could also be used to increase passenger usage and patronage while also improving operational efficiency.

Challenges Addressed

There needs to be a focus on encouraging evidence-based decision-making in public transport operations by using digital tools.

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Gender Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

Not Specified

Who can help?

GIZ India

Why care?

Use of reliable data analytics in optimising public mobility operations

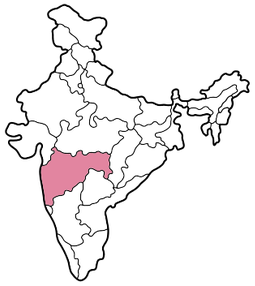
Impact

- Officials from both cities - Bhubaneswar and Trivandrum, were given hands-on training to operate the respective data tools
- Gender disaggregated data was collected in both cities to analyse travel patterns based on gender
- Realising the importance of reliable data analytics in bus operations, both cities plan to integrate the given solutions into existing operations and upscale to other cities too

28

Electric Buses for Clean Mobility

Pune and Pimpri-Chinchwad, Maharashtra



Timeline: *2019 to 2022*

Location: *Pune and Pimpri-Chinchwad, Maharashtra*

Scale: *City scale*

Funding Agency: *Pune Smart City Development Corporation Limited (PSCDCL)*

Policies/Schemes/Plans: *Maharashtra - Electric Vehicle (EV) policy, Subsidy by Smart Cities Mission for 500 e-buses*

Agencies: *Pune Mahanagar Parivahan Mahamandal Limited (PMPML), Pune Municipal Corporation (PMC), Pimpri-Chinchwad Municipal Corporation (PCMC), Pune Smart City Development Corporation Limited (PSCDCL), Institute of Transportation and Development Policy (ITDP)*

Project Cost: *INR 2.5 billion*

Alliance Partners: *ITDP*

About the Project

In India, the transport sector is responsible for 14 percent of overall greenhouse gas emissions, and e-buses can help reduce the emissions. This project helps meet the target outlined by Maharashtra's Electric Vehicle (EV) policy of achieving 25 percent electrification of the public transport fleet. Pune Smart City Development Corporation Limited (PMPML) has undertaken the deployment of 500 electric buses (e-buses) with an upfront subsidy of INR five million per bus. The operational model follows gross cost contract (GCC) or operations expenditure, where periodic payments will be made to the operator by PMPML.

Objectives

E-buses have a drastically lower environmental footprint as they require lower energy/km to operate. As per the benchmarks laid out by the Ministry of Housing and Urban Affairs, cities require 60 buses per 100,000 population. In the twin cities of Pune & Pimpri-Chinchwad, cumulatively, there are 25 e-buses of nine metre (9m) and 450 e-buses of 12 metre (12m) which would be deployed.

Project Implementation

The minimum daily utilisation requirements are 225 km/bus in the first two tenders of 150 buses and 200 km/bus in the third tender of 350 buses. All the 12m e-buses are BRT compliant, with doors on both sides of the bus for boarding and alighting at median BRT stops as well as regular stops. As per a 2022 survey conducted by PMPML in association with ITDP India among e-bus commuters, 78 percent of respondents prefer to travel by e-bus because of less noise and vibrations.

Monitoring, Evaluation, and Management

The GCC contract defines the service benchmarks for the operator to ensure efficient commissioning and smooth operations of the buses in the city, such as assured daily kilometres, kilometres of run on a single charge, etc. As per the contract, the operation and maintenance of the e-buses are undertaken by the operator.

Inadequacies and Learnings

The electric bus is a new technology, and hence to reduce the risk, Pune started by operating a smaller fleet of 150 buses and then procured further buses after measuring the impact and benefits of the existing buses.

Electric bus fleet in Pune

The electric buses are pollution-free, air-conditioned, and much smoother

Most city and state transport undertakings - the agencies responsible for public bus operations in India lack the technical knowledge to procure, deploy, and manage e-bus fleets optimally. Several undertakings also face funding gaps and do not have budgets to make direct purchases, leading to a slow uptake of the schemes by the government.

Scalability

Pune and other cities have the potential to achieve a 100 percent electric public transport fleet to contribute towards India's zero-emission targets by 2070. Convergence Energy Services Limited (CESL) plans to aggregate the demand for e-buses from different cities and float a common tender for 50,000 e-buses after successfully aggregating the demand for 5,450 buses.

Challenges Addressed

- E-buses have a drastically lower environmental footprint and can reduce carbon emissions and improve air pollution
- Through the stage-wise approach, starting with a smaller fleet of e-buses, Pune was able to measure the impact and benefits

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Gender Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 2.5 billion

Who can help?

ITDP, Pune Smart City Development Corporation Limited

Why care?

E-buses have a low environmental footprint and high passenger footfall

Impact

- As the e-buses are BRT compliant, the accessibility from the bus stop into the bus is more inclusive towards women, children and people with disabilities
- The e-buses are more cost-efficient to operate compared to diesel/CNG buses, especially with rising fuel prices
- The operation of electric buses have helped to reduce the CO2 emissions by 16,326 tonnes since the inception of their operation in February 2019 till July 2022
- Passengers per day is 35 percent higher on the new fleet of buses

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Gender Inclusive Urban Transportation

Bhubaneswar, Odisha

Timeline: *May 2021 to July 2022*

Location: *Bhubaneswar, Odisha*

Scale: *City scale*

Funding Agency: *GIZ India*

Policies/Schemes/Plans: *FAME II, Draft Odisha Electric Vehicle Policy -2021*

Agencies: *Government of Odisha Housing and Urban Development Department, Capital Region Urban Transport (CRUT), ARUNA NGO*

Project Cost: *INR 1.04 million (EUR 12,000)*

Alliance Partners: *GIZ India*

About the Project

The Mo E-Ride derives all its power from the people behind the wheels. The women and transgender people are the driving forces behind the concept of e-rickshaws introduced in Bhubaneswar. In an effort to move towards gender inclusion and women empowerment through public transit pilot project, the Mo E-Ride seeks to normalize the existence of women and the third sex in the urban transportation sector. They serve as drivers-cum-operators of e-rickshaws, providing a respectable and lucrative livelihood alternative. These people are the change makers, the ones who will take the initiative forward - the 'Sarathis', as they would be known.

Project Implementation

The pilot project was initiated with 50 e-rickshaws in the first phase to serve as a feeder service to the existing Mo-Bus service covering Bhubaneswar. The project was co-created by employing an extensive communication and outreach campaign to ensure buy-in from the residents, existing unorganised operators, and leadership. The operational model was developed based on the CapEx and OpEx model. An e-rickshaw operating model established by Capital Region Urban Transport (CRUT) is unique as the beneficiaries are not the owners /operators of the vehicle but employees of CRUT and do not pay a fee to the government or any third party and instead draw a fixed salary.

The 'Sarathis' came on board after several rounds of meetings with self-help groups and transgender communities. After two months of training, both theoretical and practical, the beneficiaries are all geared up for being out and about the streets of Bhubaneswar, connecting people's doorsteps to Mo bus stops. The 'Sarathis' are the face of Mo E-Ride and their contributions and participation makes Mo E-Ride a first-of-its-kind electric shared urban public transportation. These 'Sarathis', with willingness to carve a name for themselves and hopes of a better future, share their stories and life journeys. The project can become a case study for cities looking to provide clean energy first/last mile solutions by integrating livelihood creation and gender-inclusive mobility with electric vehicles.

Challenges Addressed

People are at the core of urban mobility. As a primary agency to operationalise public transit, the Government of Odisha and CRUT have been committed to providing people-centric operations and staying aware of the changing needs of commuters to expand their reach. The city's public transportation has undergone its long-awaited facelift as Electric Buses and Rickshaws are ready to serve the citizens of Bhubaneswar.

The newly introduced Electric Buses will provide zero-emission transportation whereas Mo E-Ride will provide as a feeder service (last-mile connectivity) to Mo Bus. With the support of the Government of Odisha, CRUT aims to expand its services across other cities in Odisha. These electric mobility options will provide people with a safe, affordable and environment-friendly way to move around.

Bringing the change with all the participating women, transgender, and disadvantaged sections of society

'Sarathi' with passengers

How much?

INR 1.04 million

Who can help?

GIZ India, Government of Odisha

Why care?

More than 120 'Sarathis' (beneficiaries) trained for e-rickshaws

Impact

- Seamless first/last mile connectivity to Mo-Bus users
- GHG emissions reduced with e-rickshaws
- Gender inclusion though women and transgender drivers
- Livelihood enhancement for the communities as they don't have to pay any government fee but receive a fixed salary

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Gender Inclusion

Behavioural Change

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Non-Motorised Plaza raises Quality of Life

Chennai, Tamil Nadu

Timeline: *Mid 2018 to November 2019*

Location: *Chennai, Tamil Nadu*

Scale: *City scale*

Funding Agency: *Chennai Smart City Limited for DPR preparation - Go.TN (I&A funds), World Bank (through Chennai City Partnership)*

Policies/Schemes/Plans: *Non-Motorised Policy, 2014*

Agencies: *Greater Chennai Corporation(GCC), Chennai Smart City Limited(CSCL),Chennai Metro Water Supply and Sewerage Board (CMWSSB), Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO), ITDP*

Project Cost: *INR 380 million - pedestrian plaza with a length of 1.5km; INR 200 million per km - Chennai Mega Streets*

Alliance Partners: *Institute for Transportation and Development Policy (ITDP)*

About the Project

The project enhances the shopping experience by reclaiming public space for the shoppers, where one looks at a street as a mobility corridor and a social, public space for everyone of all ages. Pondy Bazaar is one of Chennai's most popular shopping destinations. Pondy Bazaar is the initial 700 m stretch between Panagal Park and Thanikachalam Road. A study by the consultant appointed to redesign the plaza revealed that nearly 4,958 people walk down the stretch per hour during peak periods.

The city was also the first Indian city to adopt the Non-Motorised Policy in 2014 since the city has transformed over 200 streets into pedestrian-friendly streets with continuous footpaths.

Objectives

> Enhancing road safety through better street design solutions
> Managing on-street parking and reducing congestion
> Improving mobility for all and air quality of the street
> Eliminating the need for road/footpath cutting through well-designed utilities

Project Implementation

To ensure the longevity of the plaza and eliminate frequent road/footpath cutting, all the under utilities, including water supply lines, rider sewer, power cables, telecom cables, and stormwater drains, were newly constructed. It required a synergy among all the utility service providers (CMWSSB, TANGEDCO) and traffic police through regular coordination meetings and site visits. While launching the Chennai Mega Streets programme, the city adopted the Chennai Street Design Guidelines to ensure all design consultants followed the design standards.

> Regular site visits were conducted to check the implementation quality and compliance with the design
> Post-inauguration, Institute for Transportation and Development Policy (ITDP) conducted a perception survey to understand the project's impact
> Greater Chennai Corporation (GCC) has adopted the Monitoring and Evaluation framework as part of Chennai Street Design Guidelines
> The GCC has appointed a service provider to maintain the street, plaza, and other liveability components

Large vibrant pedestrian streets as public space for the city

The street has witnessed high footfalls and has become a vibrant public space for people of all ages to socialise, shop, and walk. With the holistic redevelopment approach, the street has not seen any road cuts for utilities since its implementation.

Inadequacies and Learnings

Key learnings from the pedestrian plaza project were:

> Interdepartmental coordination with service departments, traffic police and the municipal corporation
> Conducting regular stakeholder discussions to get their unhindered support during design development as well as during and after implementation

Scalability

Post learning from the positive impact of the plaza, the city launched the Chennai Mega Streets Project with a vision to improve over 100 km of Chennai's streets through a holistic approach.

The Chennai Mega Streets Project covers six neighbourhoods with 117 km of arterial and sub-arterial streets owned by GCC. Six national design consultants are developing the Detailed Project Reports (DPRs) for the six neighbourhoods. Phase One of implementation will commence soon for the larger project.

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 380 million

Who can help?

ITDP, Chennai Smart City Corporation

Why care?

Transformed over 200+ streets into pedestrian-friendly ones

Impact

> Reduction in traffic congestion and streamlining of on-street parking. Improved longevity of roads as the need for road cuts was eliminated with the provision of maintenance holes at regular intervals
> Apart from being a vibrant public space, this street became the only accessible public space during the COVID-19 pandemic
> ITDP conducted a perception survey in December 2019 to understand the project's impact. The survey showed that all respondents found the street safer than before

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Responsible Public Transport

Kochi, Kerala

Timeline: *2016 to 2023*

Location: *Kochi Metropolitan Area, Kerala*

Scale: *City scale*

Funding Agency: *Concessional Loan under the Official Development Assistance through the KfW under Indo-German Development Corporation*

Agencies: *Kochi Metro Rail Limited, Local bodies at town and village level*

Project Cost: *INR 8.28 billion (EUR 112 million)*

Alliance Partners: *KfW*

About the Project

The water metro project revives the inland waterways through investments in modern ferries, jetties, and last-mile connectivity around the jetties (e.g. electric feeders, bicycle sharing and walkways) with emphasis on accessible infrastructure and safety, provisions for women and differently-abled.

Objectives

> Provision of energy efficient electric ferries to replace the existing diesel ferries which cause extensive air and water pollution
> Organise the traditional Water Passenger Ferries into a formal mass public transport system with modern technology integration for ticketing, navigation, passenger information, etc.
> Connect islands via a sustainable system so as to defer and avoid provisions supporting more and more private vehicles in short and long term

Project Implementation

The project involves 15 identified routes connecting 38 boat piers/jetties across 10 island communities with 500,000 inhabitants and a 76 km route network. The routes are expected to cater to a demand of about 100,000 passengers daily ridership by 2035 after completion of the project, with the introduction of 78 new hybrid boats being operated every 10 to 20 minutes, together with an organised, reliable and considerably extended system of operation. Last mile connectivity, intelligent navigation, GPS tracking and solar component for ancillary services on ferries is also planned. The entire water transport project is proposed to be fully operational by 2024.

Scalability

During implementation, the project established scalable technology, which has a high impact and potential for large-scale integration and inclusion.

> Introducing new technology was critical for the project, and a detailed assessment before implementation is vital
> The inadequacies arose due to the capacity of some contractors to meet quality and other compliance
> Experience with established components from the metro rail system came in handy for integration and ticketing

Introduction of the boats on to the stations

One of the water metro station's as a part of 76 km route

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Gender Inclusion

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Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 8.28 billion

Who can help?

KfW, Kochi Metro Rail Limited

Why care?

Estimated GHG emission savings is about 158,000 tonnes in 20 years

Impact

> Time savings and inclusion by the introduction of new technology spaces. Expected time savings are approximately 30 percent compared to road traffic in Kochi
> Estimated savings in Greenhouse Gas (GHG) emissions are foreseen to be about 158,000 tonnes in 20 years by replacing the presently used inefficient ferry boats with modern and cleaner hybrid ones, with a reduction of oil consumption by about 45 percent
> Seamless mobility induced economic development

Success Factors

Working with a strong and experienced public transport organisation responsible for mass mobility in the city was helpful for context setting, implementation under local conditions, reaching out to stakeholders such as island committees and Urban Local Governments (ULBs), and ensuring compliance and overall project management.

Estimated indirect savings by modal shift impacts expected, in addition to the sustainable impact on the environment and natural resources through energy efficient ferries, an indirect impact on the social and economic livelihood of the island population, ease the access to employment, schools and health centres.

There is a significant positive climate impact by a reduction in Green House Gases (GHG) emissions and reduced diesel consumption.

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Citizen App for Urban Flood Management

Bhubaneswar, Odisha and Kochi, Kerala

Timeline: 2020, *2 months*

Location: *Bhubaneswar, Odisha and Kochi, Kerala*

Scale: *City scale*

Funding Agency: *GIZ India and Bhubaneswar Smart City Limited*

Policies/Schemes/Plans: *Smart Cities Mission, National Disaster Management Act 2005, ICT-based adaptation for climate change (ICT-A)*

Agencies: *GIZ India, Bhubaneswar Municipal Corporation (BMC), Bhubaneswar Smart City Limited, Bhubaneswar Development Authority (BDA), Kochi Municipal Corporation (KMC), Kochi Smart City Limited*

Project Cost: *INR 4 million (USD 63,000)*

Alliance Partners: *GIZ India*

About the Project

Mu City Saviour is designed to facilitate data exchange between citizens and the municipal administration to maintain and clear the city's stormwater drainage systems. Co-created, tested and implemented in the city of Bhubaneswar, it aims to support municipal urban storm water management while raising awareness about climate change impacts on cities.

Bhubaneswar and its citizens are prone to urban flooding during the seasonal monsoons. Heavier rainfall and changing, less predictable rainfall patterns resulting from climate change, coupled with inadequate disposal of solid waste, often directly into the drains, exacerbate this challenge. The Mu City Saviour digital application lets its citizens report on identified critical points in the urban drainage system in real-time. This data, in turn, promotes an evidence-based cleaning schedule on behalf of municipal staff, which also considers data about the affected population, business, health and traffic, as well as hydrological data such as predictions and regular rainfall data, type of drainage, etc.

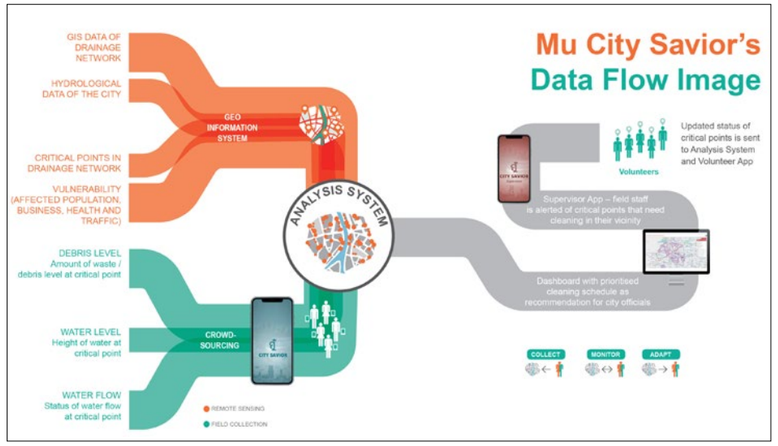
Objectives

The project's objectives revolved around a set of strategic principles for climate digital cities, which were to:

> Foster citizen engagement by allowing a wider range of experiences and knowledge to find solutions to harness collective wisdom
> Tackle local climate challenges by collecting and collating data and information to develop measures for climate adaptation
> Contribute to the city's planning process by identifying missing data needed to increase urban resilience
> Drawing up local innovation ecosystems to promote co-creation
> Contribute to the long-term vision of the city, setting short-term actions
> Facilitate transferability and up-scaling by managing knowledge and documenting innovative approaches and good practices precisely
> Making responsible use of data by strengthening the citizens' digital competencies to recognise risks and threads
> Prioritising open source and trying to reduce software and license dependencies for local governments and other stakeholders

Project Implementation

Mu City Saviour, the digital solution, was initially developed under a GIZ global programme called ICT-based adaptation to climate change in cities (ICT-A) and later taken up by the Climate Smart Cities (CSC) project. Under the CSC project, the system was extended to the entire city of Bhubaneswar and Kochi.



Mu City Saviour's data flow image

The solution was developed and implemented using a citizen-centric approach through design thinking. The project was implemented in three phases. First phase involved testing, second phase was implementation in a pilot area, and third phase was scaling up for the entire city. An amount of INR four million was spent including five years of operation and maintenance.

Monitoring, Evaluation, and Management

A monitoring system was developed in a phased manner. Each phase was monitored closely by the city administration and GIZ. This system can be operationalised and managed by the city with minimal cost or any other private service provider can manage it too.

Inadequacies and Learnings

> The system is only cloud-based, with no sensors integrated into it
> Stable internet connectivity is required to run the digital application
> Operation and maintenance are required to be planned from the start of the project

Scalability

This model can be replicated in any city facing an urban flooding challenge. The learnings and takeaways from Bhubaneswar have also been integrated in Kochi city.

Challenges Addressed

> The project addressed the importance of storm water management and linked it to preventing urban flooding
> Behavioural change was one of the primary strategies to influence the citizens about not littering and solid waste disposal in storm water drains

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Gender Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 4 million

Who can help?

GIZ India, Bhubaneswar Smart City Limited

Why care?

Strengthening citizens' digital competencies for storm water management

Impact

> Reducing urban flooding incidents by integration of tools in Bhubaneswar Command and Control Centre
> The project focussed on teenagers, students and senior citizens to gather accurate data. Roadside vendors and big establishments were involved as well for holistic citizen participation along with all genders
> The system has been developed through a human centric approach with no sensors
> Empathy research was focus on pain points, needs and wants of the citizens

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City Flood Modelling Service for Dams

Surat, Gujarat

Timeline: *October 2012 to January 2014*

Location: *Surat, Gujarat*

Scale: *City scale*

Funding Agency: *TARU/SCCT*

Agencies: *Surat Climate Change Trust (SCCT)*

Project Cost: *INR 3.05 million (USD 49,230)*

Alliance Partners: *IIT Delhi*

About the Project

The project was intended to reduce the intensity of floods and resultant flood damage to Surat through:

> Improved reservoir operation to minimise peak floods
> Better preparation of institutions and society to handle flood emergencies

The 2006 Surat flood occurred from seventh to 10th August 2006, affecting Surat and nearby villages. About 80 to 95 percent of Surat was flooded. The sudden release of a large amount of water into the Tapti River from the Ukai Dam caused the flood. Ukai Dam has a catchment area of about 62,255 sq. km and the reservoir area at FRL is 520.00 sq. km Ukai Dam has a designed gross reservoir capacity of 8511 MCM with live capacity as 7092.5 MCM (dead storage of 1418.5 MCM). It inundated 170 villages, affecting more than 16 000 families, 90 percent them belonging to the tribals.

Project Implementation

> Hydrological model setup, calibration and validation
> Use high-resolution gridded rainfall forecast data from IMD (WRF and MME models) and GFS (NASA forecast model at three hourly scales), and TRMM (Satellite rainfall data at hourly scale)
> Generating inflow forecast for Ukai reservoir - three times daily

Monitoring, Evaluation, and Management

Adequate training was imparted. The early warning system was implemented in the Surat Municipal Corporation, and hand-holding for four years to issue flood warnings during the monsoon period. Authorities can decide on dam operation/releases and warning and alert at the downstream area of the catchments for evacuation.

Scalability

The early warning system which can be implemented for any geographical area after properly calibrating and validating the respective drainage system. Based on the observed trends of floods and the water release practice issues at Ukai reservoir, an early warning system using state of the art technology was developed for better management of water release.

Challenges Addressed

> Minimise risks of flooding and risk of loss of irrigation water in summer

Ukai Dam has a catchment area of about 62,255 sq. km

Release of water monitored by flood forecast

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

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Urban Planning, Green Cover and Biodiversity

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Mobility and Air

Water Management

Waste Management

How much?

INR 3.05 million

Who can help?

IIT Delhi

Why care?

Improved reservoir operation to minimise peak flood damage

Impact

> Using the model operation of the Ukai dam can be managed in such a way that reservoir retains maximum water to satisfy various demands and reduces the flooding of Surat city
> The SWAT hydrological model has been used to simulate the inflow to the Ukai reservoir
> Flood forecast has helped the authority release water slowly to avoid any flood-like situation in and around Surat

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Climate Proofing through Flood Forecasts

Bhubaneswar, Odisha

Timeline: *March 2016 to February 2017*

Location: *Bhubaneswar, Odisha*

Scale: *Regional scale*

Funding Agency: *DFID/ACT, Inter Cooperation Social Development*

Policies/Schemes/Plans: *DFID - Climate Proofing Growth and Development (CPGD) Programme*

Agencies: *Water Resource Department Odisha (WRD), Flood Forecasting Cell - Bhubaneswar, Flood Forecasting Cell - Hirakud Dam*

Project Cost: *INR 2.3 million (USD 38,280)*

Alliance Partners: *IIT Delhi*

About the Project

This project was aimed towards improving the institutional capacity for better management of floods and water resources in the Mahanadi Basin to reduce flood damages. A real-time flood forecasting system was developed using hydrologic and hydraulic modelling for the Mahanadi Basin. The developed model was installed in their centre, and the desired capacity building of the relevant department was done to operate the system.

Objectives

> A key objective of the project was to address data gaps and identify the data required for the food forecast modelling
> Investing in the hydrologic and hydraulic model infrastructure to mitigate flooding risk
> Presentations to demonstrate the model's functionality alongside test runs and validation of the model
> Preparation of a brief intermediate report and presentation on the first validation run

Project Implementation

> The real-time flood forecasting for identified locations in Mahanadi Basin has been implemented through the Department of Water Resources, Government of Odisha
> The local staff were trained to operate and manage the system at the site (both Hirakud Dam site and Bhubaneswar) and in Delhi as a part of hand-holding and capacity building
> Web-based flood forecasting application was installed at the Hirakud dam site and flood forecasting cell Bhubaneswar

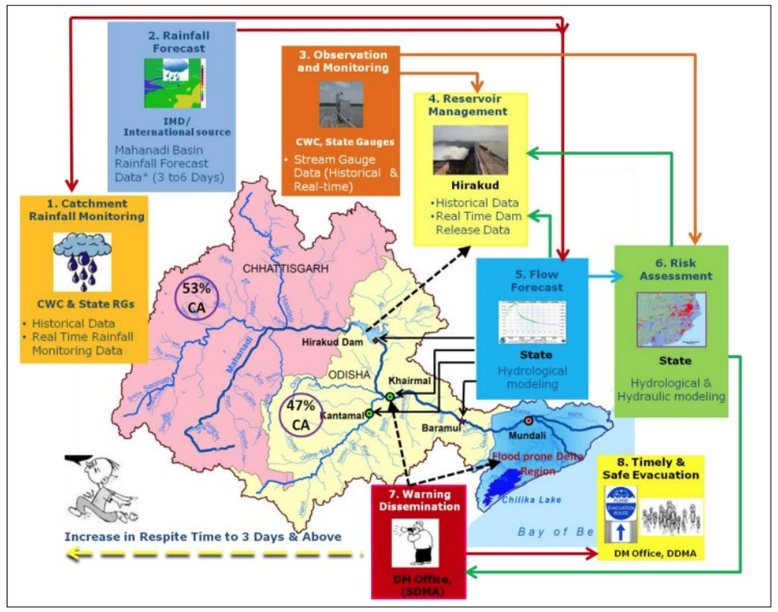
Monitoring, Evaluation, and Management

Evaluation of the forecasts issued was undertaken and found to be satisfactory. Integrated Natural Resource Management (INRM) Consultants did three years of hand-holding to build the necessary capacity to handle the model. Also, daily comparison for monsoon inflow was done parallelly at the INRM office to monitor and evaluate the model.

Inadequacies and Learnings

Since this was one of the first live flood forecasting web-based applications, we learned and improved on various application intricacies. Also, it was felt that a good mechanism to judicially operate the reservoir by getting an early warning of inflow

Mahanadi basic forecasting to reduce flood damage



Typical end-to-end early warning systems framework and elements

is required for all major and medium dams. However, there were data inadequacies like the unavailability of reservoir operation data, diversion data, etc., which impacted the model-generated outputs. The unavailability of data was the biggest challenge. Data collected on water released from man-made structures is one of the critical parameters and was unavailable and therefore, affected the overall output.

Scalability

The system can be installed in any of the river basins after calibrating and validating the model on the specific basin.

Challenges Addressed

Inflow forecast with good lead time is always a challenge. Addressing the challenge by hydrological modelling of the catchment with a web-based early warning system was done under this project.

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 2.3 million

Who can help?

IIT Delhi, Water Resource Department (WRD) Odisha

Why care?

Early warning flood forecasting reduces flood damage

Impact

> The biggest advantage of the system is to provide early warning about the flood at any point of interest in the basin, which can be used to lower the impact of flooding by saving lives and mobile properties
> The warning with longer lead time also provides an opportunity for the dam operators to manage the release of water from the reservoir more judiciously, ensuring the dam's structural safety and that downstream areas are not flooded
> The system can ensures the reservoir shall be full at the end of the monsoon period, thereby making more water available for various demands

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

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Early Flood Warning for Climate Resilience

Kolkata, West Bengal

Timeline: *November 2017 to August 2020*

Location: *Kolkata, West Bengal*

Scale: *City scale*

Funding Agency: *Asian Development Bank (ADB) - Urban Climate Change Resilience Trust Fund*

Agencies: *TARU Leading Edge, PricewaterhouseCoopers, Antea Group, Kolkata Municipal Corporation (KMC)*

Project Cost: *INR 5.57 million (USD 89,885)*

Alliance Partners: *IIT Delhi*

About the Project

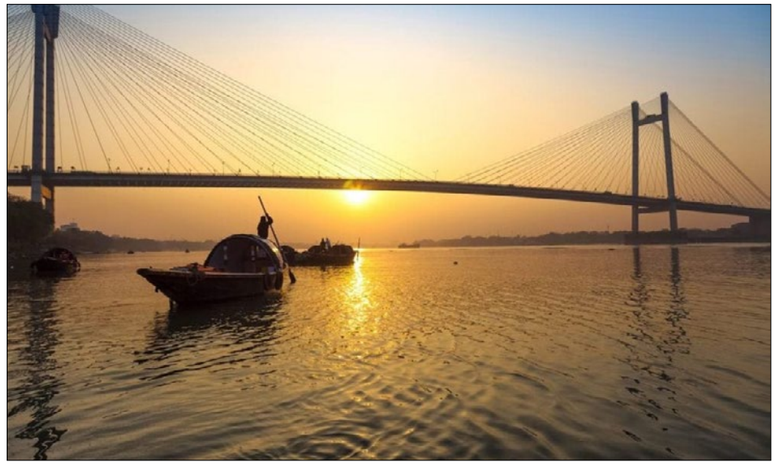
The main objectives of this project were urban flood modelling and the development of an early warning system for Kolkata Municipal Corporation. KMC, with a total area of 187 sq. km and housing a population of 4.6 million is the largest urban local body in West Bengal and also one of the largest in India.

Project Implementation

> Total stormwater system of Kolkata city was analysed using storm water management model (SWMM) urban storm water management model
> A real-time early warning system was implemented for the system. Development planning with disaster resilience considerations in municipal planning and budgeting was done with a set of 60 extreme event scenarios including combinations of excessive rainfall, tide and fluvial floods and drainage system failures with inundation maps (GIS) and videos
> Improvements in gated outfall system were suggested. Identifying areas more susceptible to flooding along with hydraulic modelling of the river and canals to inform forecast scenarios along with suggestions on the improvement of a meteorological forecast system were given
> Uncertainty analysis of Flood Forecasting and Early Warning System (FFWS), visualisations of the same along with the system software and hardware support was provided
> A catchment hydrological model and a HEC-RAS hydraulic model were prepared to facilitate SWAT for Hooghly basin downstream and study the outflow, constrictions and pumping stations of the canal respectively
> Flood forecasting and early warning systems support along with the training of staff for using and updating the systems was provided

Inadequacies and Learnings

There were places where the baseline data could not be validated, and appropriate assumptions were made.



The project is on the Hooghly river of Kolkata

Flood forecasting and early warning systems aids in infrastructure and social disaster

Monitoring, Evaluation, and Management

> An evaluation was done to compare the simulated flooding locations with the actual ones. The match was reasonably good
> Hand-holding was done for two years

Scalability

The system can be used for any city after setting up the model using the baseline infrastructure of the city.

Challenges Addressed

Strengthening Kolkata's climate resilience through improved planning and disaster risk management.

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 5.57 million

Who can help?

IIT Delhi

Why care?

Stormwater flood warning system for disaster resilience

Impact

> A portal was created for disseminating early warning to the citizens
> The working models were deployed in the KMC, and training was imparted to run the model for issuing a warning
> The system has the potential to help the local municipality to manage the urban floods more effectively

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Sponge City For Urban Flood Management

Bhubaneswar, Odisha

Timeline: *May 2020*

Location: *Bhubaneswar, Odisha*

Scale: *City scale*

Funding Agency: *GIZ India*

Policies/Schemes/Plans: *Smart Cities Mission*

Agencies: *GIZ India, Bhubaneswar Municipal Corporation (BMC), Bhubaneswar Smart City Limited, Bhubaneswar Development Authority (BDA)*

Project Cost: *INR 107.3 million (USD 1,450,000)*

Alliance Partners: *GIZ India*

About the Project

The idea behind a sponge is to make strips of land throughout the urban infrastructure permeable to help absorb extra rainwater and prevent flooding and stagnant water. If water is discharged slowly instead of letting it run off or collect on concrete infrastructure, people and cities can actually use it. Examples of direct use could be groundwater recharge, watering parks and greenery, using for recreational measures, building storage facilities, or for the domestic use of water. Indirect benefits of water collection and slow and steady absorption would be the cooling effects due to slow evaporation of water, better air quality, an increase in quality of life, and a decrease in cost for additional maintenance and tunnelling of water across further distances.

The above idea has been the focus area and guiding principle to develop the catchment area of drain no. 10 of the Nayapalli area towards the model of a 'sponge city' concept. It will not only improve the situation in Nayapalli during the rains but also provide the city with an opportunity for the development of the entire length of drain no. 10.

Considering the Sponge City perspective, three guiding workshop questions were formulated as follows:

> How to hold rainwater in Nayapalli area to reduce the amount of water in drain no. 10?
> How to improve the situation during regular rains in Nayapalli and make use of it?
> How to enhance the quality of open space and the citizens' quality of life?

Project Implementation

The solution was developed by adapting a human-centric urban design method. The developed solution comprises blue and green engineering components such as bio fencing, rainwater harvesting, drainage design, and street design concepts. One of the challenges experienced was the lack of available geospatial data.

Perforations on the sidewalks

Monitoring, Evaluation, and Management

> Close monitoring since the system was developed in a phased manner by the city administration and GIZ
> It requires minor and regular maintenance of the developed infrastructure, such as stormwater drains, rainwater harvesting points, and bio fences

Scalability

This model can be replicated in any city facing an urban flooding challenge.

Challenges Addressed

> Reducing the pressures of urban flooding on a city
> Storm water management
> Resource efficiency

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 107.3 million

Who can help?

GIZ India, Bhubaneswar Municipal Corporation

Why care?

Solution comprises of blue and green engineering components

Impact

> Citizen participation in the development of solutions
> The city accepted the proposed solutions
> Reducing urban flooding incidents and congestion in the city
> Groundwater recharge using the rainwater harvesting technique
> Optimal use of resources

37

Urban River Management Strategy

Kanpur, Uttar Pradesh

Timeline: *August 2020 to June 2021*

Location: *Kanpur, Uttar Pradesh*

Scale: *City scale*

Funding Agency: *National Mission for Clean Ganga*

Policies/Schemes/Plans: *Smart Cities Mission (SCM), Atal Mission for Rejuvenation and Urban Transformation 2.0 (AMRUT 2.0), Swachh Bharat Mission 2.0 (SBM 2.0), and National Mission for Clean Ganga (NMCG)*

Agencies: *Kanpur Nagar Nigam, Kanpur Development Authority, Jal Nigam, Forest Department, Tourism Department*

Project Cost: *INR 1.2 million (USD 15,000) for the plan, INR 533 million (USD 6.5 million) for implementation*

Alliance Partners: *River Cities Alliance*

About the Project

This project aims to outline a dedicated river strategy for managing the extent of the rivers Ganga and Pandu in Kanpur, efficiently and sustainably. The need for the project stemmed from the realisation among local stakeholders in Kanpur that a river and a city have a symbiotic relationship. On the one hand, a river provides a range of ecosystem services like provisioning, regulating, cultural, and support towards the city. On the other hand, river-sensitive development in cities helps the river maintain its natural flow and other characteristics. Therefore, the Urban River Management Plan (URMP) is based on the three pillars of sustainable development, i.e. environment, economy and society.

Objectives

A core objective of the Urban River Management Plan (URMP) for Kanpur is to strengthen the river-city bond. Hence, several interventions address this aspect. These include:

> Celebrating 'River Day' on an annual basis
> Organising river-related competitions for students
> Engaging citizens in river water quality monitoring and river clean-up activities

Project Implementation

As the first step, a core working group comprising 11 members from eight organisations, chaired by the Commissioner of Kanpur Nagar Nigam (KNN), was set up to lead the development of the URMP.

Next, a rapid baseline assessment was carried out to understand the ground reality of river-related issues and challenges faced by the city. The baseline included information on planning provisions related to rivers, water bodies, wetlands, and drains with the status of river pollution, groundwater, encroachments on the floodplain etc.

Based on the rapid baseline assessment, the core working group identified 19 tangible and practical actions that are environmentally responsible, socially inclusive, and economically beneficial. Kanpur Nagar Nigam (KNN) was the nodal agency for implementing the URMP.

Existing situation of the Mama Talav (major water body), Kanpur

Monitoring, Evaluation, and Management

The implementation of the Urban River Management Plan (URMP) shall be monitored through 10 quantitative and qualitative indicators. The plan will be implemented over a five-year period.

Inadequacies and Learnings

Preparing an URMP requires close coordination and cooperation among different government agencies. Hence, the main risk was the willingness of these agencies to share data and information. To address this challenge, several meetings were organised under the convening authority of the Commissioner to secure the required nod from these stakeholders.

Scalability

Kanpur was the first city in India to prepare an urban river management plan (URMP). This has inspired several other cities, such as Aurangabad, Ayodhya, Bareilly, Moradabad, and Prayagraj.

Challenges Addressed

> Rejuvenating and restoring degraded water bodies like rivers, lakes, ponds and drains
> Strengthening the river-city connection
> Enhancing the river related economy in the city

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 534.2 million

Who can help?

Kanpur Development Authority, River Cities Alliance

Why care?

Establishing the symbiotic relationship between the river and the city

Impact

> The project has successfully brought the Pandu River to the forefront. Until now, the focus has been solely on the Ganga. With several interventions planned for the Pandu, the project has brought the river closer to the city.

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Zero-Power Zero-Energy Sewage Treatment

Bengaluru, Karnataka

Timeline: *March 2023, ongoing*

Location: *Kanakpura Road Housing, Bengaluru, Karnataka*

Scale: *Regional scale*

Funding Agency: *Reall*

Agencies: *Reall (UK investor), Janaadhar, Jain University,* Coldwell Banker Richard Ellis (*CBRE)*

Project Cost: *INR 10.16 million (USD 137,330)*

Alliance Partners: *UNEP*

About the Project

This project directly addresses the need for sustainable water and sanitation systems in Bengaluru, initially supporting student accommodation, and eventually contributing to low-cost housing stock.

Bengaluru, India's fourth largest megacity, is in the midst of a severe urban wastewater crisis. Bengaluru is not intersected by a perennial water source like a major river. Instead, surface water flows through a complex system of approximately 200 lakes interconnected by a network of open stormwater channels. 40 percent of the city's population depends on groundwater (bore wells, open wells and tankers) for daily water needs such as drinking, cooking and bathing.

This project represents a state-of-the-art sewage treatment solution for the Kanakapura Road Housing project, a Jain University student housing. This decentralised wastewater treatment system ECOSTP DEWATS employs natural processes to achieve reliable and eco-friendly sewage treatment. It operates without dependence on external power, chemicals, or the need for human intervention and daily surveillance, treating the wastewater up to the pollution control board's specifications.

The project also addresses the need for sustainable infrastructure and services for affordable housing projects. It initially provides low-cost accommodation for students, but the houses will be sold to low-income group (LIG) households after six years. This unique model guarantees 85 percent of confirmed occupancy from completion and facilitates resale units at a much lower price as a part of the project cost is recovered in rent in the initial years. The homes are designed for both - students and families, bringing the 306 low-cost housing units into the market connected to essential decentralised infrastructure.

Objectives

The project addresses acute sanitation needs in urban India. It does so through non-conventional means, demonstrating that sanitation solutions need not acerbate demand on energy supplies, water, or the existing sanitation system. By providing off-grid solutions at an affordable entry point, the project contributes to low-cost solutions to connected sanitation, water and energy crises in India.

Project Implementation

While the housing project will be completed in March 2023, the STP is complete with waterproofing to avoid leakages. Reall, a UK-based investor in affordable green homes provided 25 percent of the total project cost, and CBRE undertook monitoring activities. Most LIG houses have conventional waste disposal methods, but this project enables them to use a technology otherwise inaccessible. Through innovative design, running costs will be reduced, including less dependence on external conventional energy sources. The project implements an ECOSTP DEWATS system with a natural anaerobic digester model for affordable housing in India.

Sewage Treatment Plant addressing the need for sustainable water and sanitation

Monitoring, Evaluation, and Management

- The project is monitored by CBRE, appointed by Reall, to ensure quality and regulations, including adequate health and safety
- In the model, methane is still produced, though minimised. Safe treatment and potential future use of methane will also need to be addressed
- O&M will be provided regularly by the organisation that has developed the sewage treatment solution technology
- Maintenance of the site, as all the processes are governed by gravity, may create issues and needs to be assessed and managed. Proper use of toilet facilities and maintenance is also essential

Scalability

Major companies and developers have used the product in India. Reall and Janaadhar have agreed to use the same in ongoing and future projects for green affordable housing nationwide. The current project assesses the need for an ECOSTP DEWATS plant for this housing project. It provides an affordable solution in terms of maintenance, and if this pilot is successful, it can be replicated commercially throughout housing projects across India. It would demonstrate a climate smart approach to services and access to clean water for urban growth without depleting natural resources. As this provides a non-conventional approach, training is essential to ensure the project's success.

Challenges Addressed

- Addressing water shortages in the megacity
- Non-dependency on renewal energy sources and water scarcity
- Sustainable solutions for affordable housing in India

How much?

INR 10.16 million

Who can help?

UNEP

Why care?

Low-cost solution to tackle sanitation, water and energy crises

Impact

- Over 1,200 people are served by the decentralised and sustainable wastewater system
- 306 affordable housing units developed, linked to sustainable water and sanitation solutions in a water scarce environment facing groundwater pollution

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

39

City Zoo undertakes a Waste Makeover

Mysuru, Karnataka

Timeline: *2015*

Location: *Mysuru, Karnataka*

Scale: *Site scale*

Funding Agency: *Mysuru Zoo, Sri Chamarajendra Zoological Gardens*

Agencies: *Mysuru Zoo, Weights and Balance Department - Govt. of India*

Project Cost: *INR 19.51 million (USD 314,825) - CapEx of biogas plant*

Alliance Partners: *Mysore City Corporation*

About the Project

The Mysuru Zoo is a 157 acres (64 ha) zoo. It is one of the oldest and most popular zoos in India, and is home to a wide range of species (168). In it, the bed vermicomposting method is adopted to process the organic waste.

In order to reduce the dependency on LPG cylinders, the Zoo Authorities have set up a biogas plant within the zoo premises adjoining the vermicomposting unit.

Project Implementation

The bed vermicomposting method helps process organic waste. The dung from the enclosure is transported to the vermicomposting yard and heaped. Usually, eight to 10 days is sufficient to prepare one bed. The compost is available for purchase at the zoo precincts for visitors, farmers and the horticulture department. To boost the sales of vermicompost, the zoo authorities have started registering the brand with the Weights and Balance Department, Government of India.

The dung from the elephant's forms 70 percent of the total waste produced in the zoo. It is rich in fibre content, which helps in biogas production. The byproduct, slurry, is then used to produce manure. The biogas plant works on the principle of biomethanation/ anaerobic digestion of waste to generate biogas. Anaerobic digestion occurs in three phases, hydrolysis of organic solids, acetic acid formation and biogas production.

Monitoring, Evaluation, and Management

The bed site should be free from all debris. In the case of hard ground, flooring is generally not required. Otherwise, flooring with locally available stones is prepared for the purpose of sieving and packing. Regular watering is carried out twice a day for about 10 days, then once a day for another 10 days and then on alternate days until vermicomposting is complete. This process helps to soften the raw material and maintain the required moisture in the bed.

After one month; black, granular, lightweight and humus rich compost gets ready. To facilitate the separation of the worms from the compost, watering should be stopped two to three days before emptying of the beds. This forces about 80 percent of the worms to the bottom of the bed and the remaining worms can be removed by hand.

Biogas plant at Mysuru Zoo

The zoo uses the Eudriluseugenae species of earthworm, as they are prolific breeders with high multiplication rate

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 19.51 million

Who can help?

Mysuru Zoo

Why care?

The zoo produces 1-1.5 metric tonnes of compost per day

Impact

> The biogas plant is floating drum type and can process 1.3 metric tonnes of organic waste per day

40

Creating a Zero Plastic City

Indore, Madhya Pradesh

Timeline: *January 2016 onwards*

Location: *Indore, Madhya Pradesh*

Scale: *Site scale*

Funding Agency: *Indore Municipal Corporation (IMC), Nepra Resource Management Private Ltd. under the PPP model, Aavishkaar Venture Management Services*

Policies/Schemes/Plans: *Swachh Bharat Mission (Urban) 2014-20*

Agencies: *Indore Municipal Corporation (IMC)*

Project Cost: *Material Recovery Facility - INR 156.25 million (USD 2,520,200) by Nepra Resource Management Private; Plastic waste fuel converter unit - Capital cost of plant - INR 23.43 million (USD 378,030)*

Alliance Partners: *Indore Municipal Corporation (IMC)*

About the Project

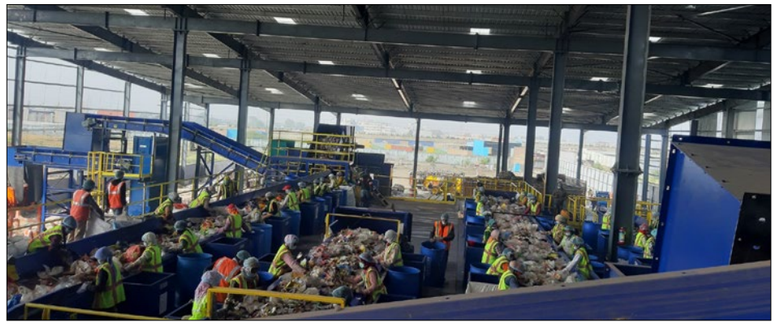
Indore city has a Centralized Processing Unit situated at Devguradia, Nemawar Road. The total area of Devguradia processing and disposal site is around 146 acres. The waste collected at the garbage transfer stations in the city is weighed, compressed and further moved to the Devguradia processing site / trenching ground for final processing. It comprises of the following units:

> Centralised Organic Wet Waste Processing Unit (Aerobic Composting Unit): All the wet waste of the bulk generators (30 kg and above) is processed within their premises
> Material Recovery Facility (MRF): At these facilities, the dry waste is segregated into different components such as metal, rubber, board, plastic, etc. The recyclable waste is sold to 14 kabadiwalas, registered and authorised by IMC. In dry waste processing, inert is recovered at both the MRFs. The inert is then transferred to the sanitary landfill located near the premises
> Plastic Waste Collection and Processing Unit: IMC has set up a plastic collection centre (PCC) to reuse and recycle the city's plastic waste. Along with setting up a PCC, IMC has also installed a plastic cleansing machine known as a 'Phatka Machine'
> Reverse Vending Machines: This innovative idea was adopted to reduce plastic bottle waste in public places and the transportation cost of the bottles. The machine has been installed at ten different public locations in the city
> Plastic waste fuel converter unit: This facility works on the reverse polymerisation process and can produce at least 3,000 litres of fuel per day with 10 tonnes of scrap plastic waste
> Bio remediation of old dumpsite: Treating the old garbage through biomining at the Devguradia dump site
> Construction and Demolition (C&D) Waste Plant: IMC has constructed a construction and demolition debris waste processing facility on a PPP model
> Scientific Landfill Site: Two engineered landfills of 6.25 acres each have been constructed and are used as and when required

Project Implementation

> Centralised Organic Wet Waste Processing Unit (Aerobic Composting Unit): The wet waste from the garbage transfer station is transported to the central wet waste processing plant, where it is processed into compost

The processing and disposal site is around 146 acres



Waste sorting section

> Material Recovery Facility (MRF): The dry waste brought to the central processing and treatment facility at Devguradia is then sorted into different categories. The waste pickers manually sorted the material at the plant in two MRF facilities, where the dry waste was manually sorted into different categories
> Plastic Waste Collection and Processing Unit: Waste pickers segregate and sell the plastic waste that can be recycled. The remaining plastic waste is then taken to the PCC, where it goes through cleaning and shredding
> Reverse Vending Machines: This intervention included a unique concept of incentivisation to encourage the disposal of plastic bottles through reverse vending machines

Challenges Addressed

> Indore was one of the biggest plastic waste generator in Madhya Pradesh in 2013

How much?	Who can help?	Why care?
INR 156.25 million for MRF	Indore Municipal Corporation (IMC)	Can produce min. 3,000 litre of fuel per day with 10 tonnes of scrap plastic waste

Impact

> Proper drainage lines are built near this area to discharge the fluid. This waste is treated properly from time to time, and the produced compost is of good quality
> The plastic waste fuel conversion unit has solved the problem of disposal of scrap plastic waste collected daily from the city
> Recovered soil, compost and recyclables have been sold and rejects have been scientifically landfilled. Indore has transformed its garbage landfill site into a beautiful garden in a short duration

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

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Creating Inclusive Sanitation Systems

Dehradun, Uttrakhand

Timeline: *Plan prepared in 2021*

Location: *Dehradun, Uttarakhand*

Scale: *Site scale*

Funding Agency: *Allocation from Uttarakhand state funds*

Policies/Schemes/Plans: *Atal Mission for Rejuvenation and Urban Transformation 2.0 (AMRUT 2.0) fund for urban development directorate plans*

Agencies: *Uttarakhand Jal Sansthan (UKJS), NIUA*

Project Cost: *INR 18.3 million*

Alliance Partners: *Forum for Inclusive and Resilient Sanitation in Hill Cities*

About the Project

Kargi Chowk Sewage Treatment Plant (STP) with 68 million litres per day (MLD) of designed capacity, is one of the highest capacities STPs. Adopting the co-treatment approach of faecal sludge and septage can help in achieving Citywise Inclusive Sanitation (CWIS).

In Dehradun, 100 percent of households have access to individual toilets. There are six sewerage zones: Kargi, Rispana, Indra Nagar, Vijay Colony, Salawala and Doon Vihar. Currently, these zones are partially served by a sewerage network covering 57,173 households which is 34 percent of the total households in the city. The remaining 66 percent of households have On-Site Sanitation (OSS), exhibiting the city's majority dependency on OSS. Two more STPs at Banjarawala and Raipur are proposed.

Objectives

The four CWIS principles are:

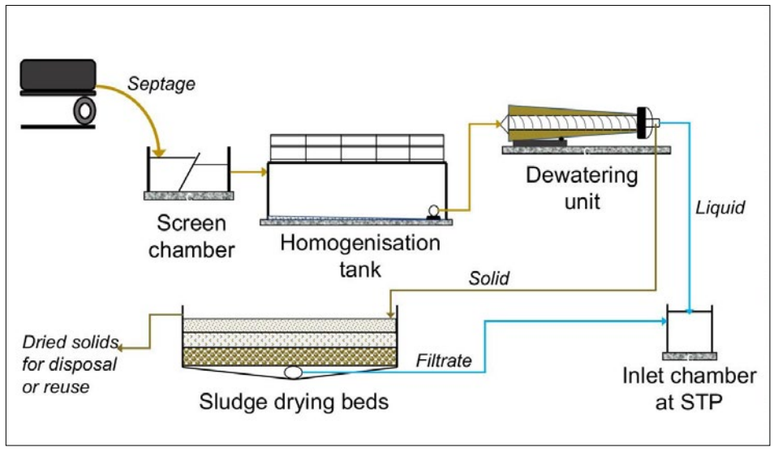
> Equal benefit for all through safe services and public investment
> Human waste is safely managed along the sanitation network
> Authorities operate with a clear and inclusive mandate
> Authorities deploy a range of hardware, funding and business models that enable adoption of simple, local, and financially sustainable technologies that increase the scope of faecal sludge and septage treatment while benefiting all the stakeholders, especially the citizens relying on on-site sanitation systems

Project Implementation

Uttarakhand Jal Sansthan (UKJS) decided to implement a pilot-scale co-treatment of faecal sludge and septage at the existing STP by conducting a pre-feasibility study and providing design recommendations for co-treatment. Considering the current faecal sludge and septage (FSS) disposal at the Kargi Chowk STP, 130 kilolitres per day (KLD) of the co-treatment facility is proposed to treat septage from Dehradun and its suburbs. The area required to construct co-treatment modules is estimated to be around 800 sq. m.

The technical design recommendations for the co-treatment have been accepted by the UKJS and processed further for the fund allocation from the Uttarakhand state funds. The proposed treatment facility is estimated to have an implementation period of three months once the construction work starts. The process will include:

> Systematic method of receiving faecal sludge and septage at the inlet of STP supports the waste management of the city and its surrounding



Proposed line flow diagram for co-treatment facility suggested by NIUA at Kargi Chowk STP

> Solid-liquid separation of incoming FSS using spare units in the STP
> Liquid stream to be mixed with incoming sewage at the STP
> Solid stream to be dewatered using centrifuge and sludge drying

Currently, around 20 MLD of sewage is received at the Kargi Chowk STP, and more than 100 KLD of FSS from 30 cesspool vehicles are disposing of faecal sludge and septage at a designated decanting station until a dedicated co-treatment unit is operational.

Monitoring, Evaluation, and Management

> 34 percent of the sewerage network, spread across six zones will need to be monitored
> Desludging frequency needs to be five to eight years
> As the On-Site Sanitation (OSS) systems mainly consist of septic tanks, the average cost of desludging for a household is INR 3,000. This can be reduced with the proposed STPs and new FFS co-treatment plant
> The capacity of desludging vehicles is 4,000 to 6,000 litres
> Wastewater treatment through seven STPs (Total capacity: 150 MLD, 34 percent utilisation)

Inadequacies and Learnings

Some of the negative effects of the proposed FSS co-treatment plant are:

> The high sludge and septage concentration in the aeration basin of STP creates difficulty
> There is a rise in odour nuisance within the STP premises
> Excess quantities of fat, oil, and grease are found to harden and block the pipes, causing the pipes to overflow or burst due to reduced capacity

Challenges Addressed

Decentralised and non-sewered sanitation systems are a paradigm shift in urban planning and infrastructure creation in most developing countries. The case study highlights that the activities are impossible without a collaborative engagement of key stakeholders and pressing the right levers at all levels.

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 18.3 million

Who can help?

Uttarakhand Jal Sansthan (UKJS), Forum for Inclusive and Resilient Sanitation in Hill Cities

Why care?

Co-treatment of faecal sludge and septage can help achieve Citywise Inclusive Sanitation

Impact

> Through the FSS management state strategy and investment plan, it is envisaged that the co-treatment facility at Kargi STP will cater to the septage treatment needs of Doiwala, Herbertpur and Selaqui Urban Local Bodies (ULBs) that are within a 25 km distance
> The project helps in achieving citywise inclusive sanitation
> It will especially support citizens relying on on-site sanitation systems

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

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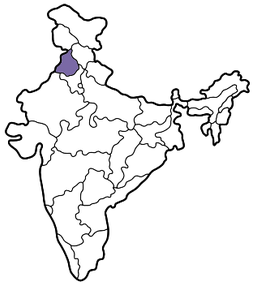
Community Financing for Segregation, Collection and Transportation

Nawanshahr, Punjab



Timeline: *September, 2017 onwards*

Location: *Nawanshahr, Punjab*

Scale: *City scale*

Funding Agency: *Community financing model with public donations and funds from civil society organisations*

Policies/Schemes/Plans: *Swachh Bharat Mission (Urban) 2014-20*

Agencies: *Municipal Council Nawanshahr*

Project Cost: *INR 4.27 million (USD 69,019) raised*

Alliance Partners: *Municipal Council Nawanshahr*

About the Project

Nawanshahr, a district of 125 sq. km housing 46 thousand people, ensures 100 percent coverage of wards through its door-to-door collection system. 100 percent segregation at source is being practiced in the city. In Nawanshahr, door-to-door waste collection is done with the help of 32 wheelcarts (rerhis) deployed for this purpose, each having a capacity of 400 kg. The wheelcarts are designed with separate compartments for wet and dry waste. This way, waste is segregated efficiently at the source as per specification. The fleet includes small carriers, rickshaws and motorbikes fitted with the collection system. The total fund raised for starting the project is INR 5.5 million through the public and people with local businesses. The Nawanshahr model is a community financing model with specialised collection vehicles .

Project Implementation

The Nawanshahr model is a community financing model of public donations and funds from civil society organisations. The administration has taken an intelligent step by collecting the leftover fruit residue from the juice vendors in the evening. So that such waste is not disposed of in waste bins and left untreated. The rotary club in Nawanshahr helped to purchase 150 pairs of PPE like gloves, masks, etc. A total of 55 workers are involved in this process.

A cost of INR 1.5 million (through donation made by residents) was used for designing the cycle rickshaws and motorcycle rickshaws for collecting the biodegradable and non-biodegradable waste in separate compartments. 150 waste bins were provided by a local cooperative sugar mill.

Door-to-door waste collection with the help of 32 wheelcarts

The wheelcarts are designed with separate compartments for wet and dry waste

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 4.27 million

Who can help?

Municipal Council Nawanshahr

Why care?

Approx. INR 2.63 million in revenue generated through user charges

Impact

> 100 percent segregation at source is being practised in the city
> 100 percent coverage of wards through its door to door collection system

43

Local Micro-Composting Centres led to No-Bins

Tiruchirappalli, Tamil Nadu

Timeline: *2016 onwards*

Location: *Ambethkar Nagar, Tiruchirappalli, Tamil Nadu*

Scale: *Site scale*

Funding Agency: *Tiruchirappalli City Municipal Corporation*

Policies/Schemes/Plans: *Swachh Bharat Mission (Urban) 2014-20*

Agencies: *Tiruchirappalli City Municipal Corporation*

Project Cost: *INR 140 million*

Alliance Partners: *Tiruchirappalli City Municipal Corporation*

About the Project

About 27.46 tonnes of biodegradable waste is collected on a daily basis from Ward four, five and six of the Tiruchirappalli City Municipal Corporation. In order to minimize the expenditure on secondary transportation, and also to prevent open dumping, micro composting centres have been established to process the biodegradable waste.

Micro Composting Centre is a decentralised waste processing facility where solid waste collected from a particular ward or housing colony through the primary collection is scientifically processed in that specific locality. In order to minimize the expenditure on secondary transportation and prevent open dumping, micro composting centres need to be established to process the biodegradable waste. The micro composting centre comprises:

> Waste receiving platform
> Secondary segregation arrangement with organic shredder
> Pits in the required capacity to convert shredded biodegradable waste into qualitative manure
> Shredding machine
> Conveyor belt
> Stabilisation area

Project Implementation

First, a shredder shreds the collected biodegradable waste into 20 to 40 mm size. The shredded biowaste is then placed in the cubical pits over a thin layer of cow dung or matured compost. An effective microbial solution mixed with rice husk and rice bran is added to the shredded waste before placing it into the pits.

The shredded biowaste with accelerated microbial biomass reduces the volume of the biowaste to one-third within seven days. The sequence of placing the waste in the cubical pits is: 1st day- 1st pit, 2nd day- 2nd pit, 3rd day – 3rd pit and so on. The mixture in the pits is turned once in every 5 days to ensure sufficient aeration. On the 8th day, second filling of bio degradable waste is done in the same series of pits viz., 8th day- 1st pit, 9th day- 2nd pit, 10th day-3rd pit and so on. On the 15th day, third filling of bio degradable waste is done in the series of pits viz., 16th day- 1st pit, 17th day- 2nd pit, 18th day-3rd pit and so on.

Micro Composting Centre at Ambethkar Nagar

Sorting of waste

After 21 days, the second sequence stage by filling biodegradable waste happens in the series. After 42 days, the matured manure is dried, sieved and packed for distribution from each pit. Leachate is collected and utilised for moisturising the compost pit. The degraded matter is kept for three days for stabilisation/maturation before packing.

The composting process is monitored daily to maintain a high quality of operation. Compost quality is monitored based on per batch of compost sold in the market. The stock register is maintained to keep a stock of organic manure.

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?	Who can help?	Why care?
INR 140 million	Tiruchirappalli City Municipal Corporation	A decentralised waste processing facility through NGO volunteers

Impact

> Manure is distributed free of cost to the local farmers and public
> The quantum of waste transported and the number of community bins has reduced
> There were seven community bins in the city and none were in use after the introduction of micro composting centre
> The usage of secondary collection vehicles has also reduced

44

Reviving Canals: Treating Water and Waste

Alappuzha, Kerala

Timeline: *2017 onwards*

Location: *Alappuzha, Kerala*

Scale: *Site scale*

Funding Agency: *Kerala Institute of Local Administration (KILA)*

Policies/Schemes/Plans: *Canalapy DEWATS Project*

Agencies: *Cochin University College of Engineering, IIT- Bombay, National Environmental Engineering Research Institute (NEERI), Consortium for DEWATS Dissemination Society, Inspiration - Cochin.*

Project Cost: *CapEx is INR 1.71 million (USD 27,711) for 20 KLD capacity plant; OpEx is INR 156,178 (USD 1,259 - 2,519)*

Alliance Partners: *Kerala Institute of Local Administration (KILA)*

About the Project

Canalapy (Can Alappey) project is an initiative taken by the citizens of Alappuzha to reclaim the town's canals. With the tagline of 'Canals are not drains', it strives to clean, sustain and inspire people to take care of their surroundings and make a difference in society.

To explore a practical and sustainable solution, the Indian Institute of Technology, Bombay (IIT-B) and Kerala Institute of Local Administration (KILA) mapped the origin of waste in households, the household septic tank situation and people's willingness to participate in the rejuvenation process, etc.

Project Implementation

The area chosen for the Canalapy DEWATS Project pilot phase is located in the Chathanadu ward of Alappuzha municipality. The area comprises of around 90 individual houses (predominantly middle-income group), the Municipal Colony with 48 houses, some small shops, commercial establishments and a Church.

Considering the availability of sanitation facilities in the area, as assessed through surveys, the project was executed in two stages.

> At first, individual toilets were constructed for every household where no sanitation facility was available
> For the second stage, a decentralised wastewater treatment system was designed to prevent the flow of discharge from these households directly into the canal

Every household's black and grey water pipes were connected to a common underground pipe, which led to a common settling tank. The wastewater thus accumulated is further treated by channelling the effluent through several stages before releasing it into the canal.

Challenges Addressed

Alappuzha has an intricate network of canals originally constructed for inland water transportation. The rejuvenation of canals that have, over a period of time, have turned into sewers owing to indiscriminate dumping of solid and liquid wastes from residential and commercial establishments.

Black and grey water pipes from households connected to common underground pipe leading to settling tank

Treated water released into the canal

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 1.71 million

Who can help?

Kerala Institute of Local Administration (KILA)

Why care?

Rejuvenation of an intricate network of canals

Impact

> Minimal external energy needed for treatment
> Low operational costs
> Minimal maintenance
> Once the reed plants create an established stand, the plant foliage will soon blend naturally into the landscape. They make a pleasing sight as well

45

Women-led Comprehensive Sanitation

Navi Mumbai, Maharashtra

Timeline: *2013*

Location: *Navi Mumbai, Maharashtra*

Scale: *Site scale*

Funding Agency: *Bank of America, HT Parekh Foundation, Chintu Gudiya Foundation, Yardi Vasti Vikas Prakalp, Sun Vacuum Former PVT. Ltd., TRW Sun Steering Wheels Pvt. Ltd., DMI Finance*

Policies/Schemes/Plans: *Swachh Bharat Mission*

Agencies: *Center for Sustainable Urban Development, The Earth Institute, Columbia University, Faculty of Architecture, Federal University, Municipal Corporation of Navi Mumbai*

Project Cost: *INR 3.9 million (USD 63,040)*

Alliance Partners: *Shelter Associates*

About the Project

A multi-stakeholder-based cost-sharing model where the community works with the urban local body (ULB). Shelter Associates (SA) provides the toilet material, and individual toilets are built by the family and connected to the drainage laid by the ULB. The project's purpose was to provide comprehensive sanitation services to the community, driven by technology and gender inclusivity. The project involved community participation in the form of women volunteers in technology-driven data collection, understanding the data and the Geographic Information System (GIS) maps and community mobilisation to achieve and adopt safe sanitation practices by the community.

Project Implementation

The goal was to provide One Home One Toilet (OHOT) to families, encourage the families to segregate waste at the source and provide safe and hygienic disposal of household waste to the agency assigned to collect the waste. The specific tasks involved in the project implementation were:

> Slum mapping by use of technology through digitisation of maps with using QGIS
> Government partnership and liaison
> Slum, drainage, water, and solid waste management departments were validated by the respective officials
> Linked data to the municipal corporation's website for it to be available on the public domain

KAP survey and community mobilisation:

> Community volunteers

Technical assistance for building toilets:

> SA helped the community build toilets with innovative septic tanks without a drainage network
> Supply chain mechanism
> SA provides the material, the family invests in constructing the toilet, and the municipal corporation lays the necessary infrastructure for the drainage wherever possible

The data collected is disaggregated by gender, focusing on collecting data affecting women and girls

Monitoring, Evaluation, and Management

Change in leadership: Whenever there is a change in the administrative head within a ULB, there are challenges to keeping the project going, especially if there are changes in the priorities of the new administrative head.

Political resistance: Working in slums always involves the risk of political or communal resistance. Keeping the ULB and elected representatives close to the project is critical to gain their support throughout project facilitation and overcoming any hassles in completing the project.

Behavioural differences among communities: A specific section of the slum population, especially men, still adopt old sanitation methods but gradually adapt to change.

Material cost fluctuations: The toilet construction cost can vary with time, so an increase in the material cost can cause budget constraints.

Challenges Addressed

The problems addressed by the community were: Indira Nagar slum, a habitat of around 3,000 households (HHs) is situated on a hill slope with no sewer drainage network. Less than 10 percent had an individual toilet. 40 public and 57 community toilet seats were available for the rest of the population. This makes the toilet seat-to-person ratio around 1:108 (recommended ratio is 1:35).

Secondly, the Navi Mumbai Municipal Corporation (NMMC) had contracted an agency with a daily target of collecting segregated waste from 2,000 HHs in Indira Nagar. Despite their efforts, they could not reach even 50 percent of their target, causing mounting sanitation problems in the area. However, provision of household toilets to urban slum population with houses as small as 14 sq. m along with dealing governance issues related to solid waste management was done.

To know more:

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Gender Inclusion

Behavioural Change

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

How much?

INR 3.9 million

Who can help?

Shelter Associates

Why care?

Solid waste collection of 1,525 households at source

Impact

> While designing data-driven sanitation solutions, this gender data ensures women friendly interventions
> With Shelter Associates' (SA) OHOT approach, ninety-three individual household toilets using innovative septic tank toilets for the community have been built
> SA improved the range of solid waste collection to 1525 HHs within five weeks
> SA's intervention also led non-adhering HHs to contribute to the waste collection efforts and the segregation of waste at its source in the community

46

Zero-Waste City Creates its own Energy

Jabalpur, Madhya Pradesh

Timeline: *2016 onwards*

Location: *Jabalpur, Madhya Pradesh*

Scale: *City scale*

Funding Agency: *Jabalpur Smart City Limited, ESSEL Infra*

Policies/Schemes/Plans: *Swachh Bharat Mission, Smart Cities Mission*

Agencies: *Jabalpur Smart City Limited, Jabalpur Municipal Corporation, ESSEL Infra*

Project Cost: *INR 69.4 million*

Alliance Partners: *Jabalpur Smart City Limited*

About the Project

Waste management is an essential requirement of ecologically sustainable development. It is a comprehensive program optimising waste collection, transport, and disposal, along with activities to prevent, recycle, and draw energy from waste. Jabalpur Municipal Corporation (JMC) is responsible for providing municipal and civic services, including but not limited to the collection, segregation, transportation, treatment and disposal of Municipal Solid Waste (MSW) generated in the Jabalpur city of Madhya Pradesh. This civic administrative body administers an area of 263 sq. km with 1.2 million residents. Given the mounting issues of waste management, the city authorities refined the solid waste management services by building a waste-to-energy plant at Kathonda for scientific disposal of all kinds of municipal waste, thus providing an all-round solution to the waste related problems of the city.

Objectives

To develop a waste-to-energy plant at Kathonda which can yield the following benefits:

> A robust solid waste management solution to make Jabalpur a Zero Landfill City
> A royalty amount of collected waste provided by ESSEL Infra increases the revenue of JMC
> Prevention of groundwater pollution due to the application of mass burning technology
> Integration of the waste-to-energy plant with the centralised monitoring system

Project Implementation

The campaign covered various aspects of Solid Waste Management (SWM) in Jabalpur and adopted an integrated approach to strategising the activities being undertaken under the initiative as indicated below:

> Modifications and innovations in the waste collection instruments to ensure effective door-to-door waste collection services throughout the city
> Establishment of waste to energy plant to process all kinds of solid waste
> Extensive campaigns and community engagement drives to increase mass-awareness levels about the initiative and the issue of SWM

Waste management plant for the disposal of all kinds of municipal waste

Success Factors

> Strong and stable leadership
> Technical innovations for effective management of solid waste, including IT-based innovations
> Intensive campaigning for increasing the mass awareness levels about waste segregation and management
> Efficient collection of waste, reduction of littering, foul odour and unaesthetic appearance of bins
> A sense of good hygiene and environmental awareness are visible among the citizens of Jabalpur
> Better governance on the collection of daily garbage and monitoring of garbage collection, transportation system by the command control centre

Scalability

The electricity generated by waste to the energy plant is sent back to the grid for utilisation. The environment is pollution free from groundwater and air pollution. The waste-to-energy plant also helps to avoid the consumption of helpful land required for garbage dumping.

The system can easily be replicable and must be adopted by all major cities and towns of India to make a new India. The project helped significantly to achieve the targets set under Swachh Bharat Mission for Jabalpur City.

Urban Planning, Green Cover and Biodiversity

Energy and Green Buildings

Mobility and Air

Water Management

Waste Management

Innovation

Technology/ E-Governance Intervention

Capacity Building

Community Involvement

Inclusion

Behavioural Change

How much?

INR 69.4 million

Who can help?

Jabalpur Smart City Limited

Why care?

11.5 megawatt electricity generated

Impact

> The key challenge faced for the successful implementation of the WTE plant was reducing the usage of one time usable plastic (disposals) due to lack of awareness
> While ensuring cost reduction and resource optimisation, the system has contributed to improved environmental excellence
> Establishing a 10 acre waste to energy plant in the Kathonda area consumes 600 tonnes of waste daily and generates 11.5 megawatt electricity

The Gender Lens

This section demystifies the meaning of ‘Gender Mainstreaming’ and its importance in the urban space. It gives you an insight into how the gender lens is institutionalised into policies and projects and the close relationship it has with climate action. It gives us the possible thematic entry points that projects for climate action could consider while formulating a more gender-intrinsic and inclusive project.

What is gender mainstreaming?

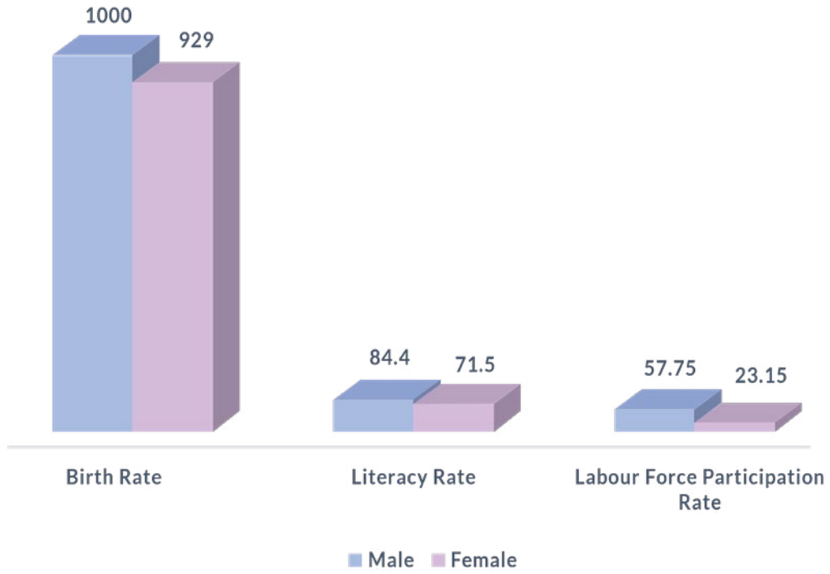
The United Nations Fourth World Conference on Women in Beijing in 1995 established gender mainstreaming as the key strategy to promote gender equality and empowerment of women. The Beijing Platform for Action called on governments and other actors to 'promote an active and visible policy of mainstreaming a gender perspective into all policies and programmes, so that, before decisions are taken, an analysis is made of the effects on women and men, respectively'.[i]

The United Nations Economic and Social Council further underscored the importance of gender mainstreaming, defining it as '...the process of assessing the implications for women and men of any planned action, including legislation, policies or programmes, in all areas and at all levels. It is a strategy for making women's as well as men's concerns and experiences an integral dimension of the design, implementation, monitoring and evaluation of policies and programmes in all political, economic and societal spheres so that women and men benefit equally and inequality is not perpetuated. The ultimate goal is to achieve gender equality'.[ii]

Entry Points for Gender Mainstreaming in Thematic Areas:

This section is an attempt to bridge the gap between the endorsement of gender mainstreaming at the program level and its translation into reality in project development.

It has examples from across the globe of how seemingly small steps towards gender mainstreaming have resulted in transformative changes. Some of the good practices like addressing gender-based violence (GBV) and generating employment for women, can be successfully replicated across the thematic areas.



The latest National Family Health Survey (NFHS), sex ratio at birth for children born in the last five years was 929 females per 1,000 males. (The World Health Organisation (WHO) estimate is about 952 females to every 1,000 males).

The male literacy rate in 2021 is 84.4 percent, while the female literacy stands at 71.5 percent.

The Periodic Labour Force Survey 2020-21 shows that the labour force participation rate among Indian women is just 23.15 percent, in contrast to 57.75 percent in men.

01

Gender Lens - Urban Planning, Green Cover, and Biodiversity

Water bodies and green spaces not only provide a better living environment but also help people to adapt to the adverse impacts of extreme climate events. Green areas also aid in carbon sequestration and minimising the impacts of air pollution.

In this thematic area, it can be seen how cities are taking measures to rejuvenate water bodies and open spaces, increase their green cover and conserve biodiversity. In addition, strategies, plans and actions adopted to build disaster resilience and climate actions are also present.

Urban planning is yet to address the specific needs of women and children, despite a growing interest in recent years in exploring the linkages between urban planning, women's empowerment, poverty reduction and climate change.

01

The Hariyo Ban Programme

Nepal

Scan to read more:

Why care?

Women in leadership roles in Natural Resources Management (NRM)

GESI strategy to increase participation of women
Source: biodiversitylinks

Where?

Nepal

What?

The Hariyo Ban Programme aimed to increase ecological and community resilience in the biodiverse landscapes of a Chitwan Annapurna Landscape and the Terai Arc Landscape in Nepal. The programme emphasised on the links between people and forests which was supported by gender inclusion as one of the cross-cutting schemes.

How?

> The Program developed an extensive Gender Equality and Social Inclusion (GESI) strategy to increase participation of women, socially backward classes, indigenous people, and poor and marginalized groups in decision-making processes and take on leadership roles in Natural Resources Management (NRM); and to ensure equitable benefit sharing.
> The programme guidelines ensured all resident community members received membership in community forests, 50 percent female representation on the Executive Committee of the Community Forestry User Groups (CFUG), representation of marginalized groups, public hearings to promote transparency, and an annual financial audit.
> More than 400 Community Learning and Action Centres were created for women to come together, identify their most pressing needs, and develop solutions to improve their communities, as well as their own livelihoods.
> Over 900 NRM groups were formed, and 70 percent of these had women in leadership positions.
> To address gender-based violence in the next phase of the programme, a cadre of men were raised as champions to fight discrimination and violence, raising awareness on gender equality and social inclusion issues to promote its mainstreaming into national policies.[iii]

Gender Impact

> Ensured participation of women and other marginalized groups in natural resources management
> It empowered women, provided agency and addressed gender based violence

02

Violence Against Women and Children (METRAC) Audit Tool

Toronto, Canada

Scan to read more:

Why care?

A women's safety audit tool created through environmental design

Photograph for representation purpose only
Source: Cities Today; Sirinarth Mekvorawuth

Where?

Toronto, Canada

What?

A women's safety audit tool was developed by the Metropolitan Action Committee called the Violence Against Women and Children (METRAC) in Toronto, Canada, in 1989. It has since been used by many cities across the world and was also declared a best practice by the United Nations.

How?

It is premised on the concept of Crime Prevention Through Environmental Design (CPTED). Women's safety audits examine a list of safety considerations for women in relation a certain space. These can include improved street lighting, women friendly public transport, accessible policing and others. Women's safety audits can be used by professional planners in planning safe public spaces. [iv]

Gender Impact

> Creating safe and empowering spaces for women and children
> Can help to the break the barriers that limit their access to involve fully in workplace, society and economy

03

Frauen-Werk-Stadt Housing Development

Austria

Scan to read more:

Why care?

Public housing designed by women for women

Frauen-Werk-Stadt Housing
Source: N Palit article, Medium

Where?

Austria

What?

Vienna, Austria, is a European city home to 1.7 million people. In Austria, 21 percent of housing is supplied or subsidised by the government. To meet the ongoing housing needs of people, new housing projects are built on a regular basis. Frauen-Werk-Stadt housing development project highlighted the role of women architects in urban planning and how it changed the way the dwellings and surrounding areas got conceived.

How?

> The project began in 1992 at the initiative of the Women's Office of the City of Vienna. The central principle of this project was housing designed by women, for women. The project sought to highlight the role of women experts in urban development. One of the key ways it achieved this was by holding a design competition in 1993, which set out design criteria based on the concept of the everyday life of women. The winning entry came from a female architect whose design included a variety of dwellings, a 'village common', play spaces and garden courtyards.
> Three other female architects were chosen to assist in the project. Women also comprised the majority of the judging panel, and a non-profit Austrian development organisation headed by a woman was chosen as the developer.
> Stage one of the development resulted in 357 flats in multi-unit blocks on a 2.3 hectare site. Construction was carried out between 1995 and 1997. 'Frauen-Werk-Stadt 1' is now home to 1,000 residents. The development offers a variety of housing types, including disabled-access flats, shop space, childcare facilities, safe car parking, a medical centre and a police station.
> Following the successes of Frauen-Werk- Stadt 1, construction on stage two began in 2002. The focus of the second stage is meeting the daily needs of elderly women. Once again, a competition was held and the winning design was chosen because of its exemplary assisted-living approach. As in stage one, emphasis on the project in stage two has been placed on providing common facilities and shared spaces, in order to foster a sense of community.
> Housing projects applying for public funding in Austria are now assessed based on the concern given to meeting the diverse needs of households and the use of community-based architecture.

Gender Impact

> This project provides a practical example of how housing and neighbourhood design can successfully meet the needs of women
> It also highlights the importance and benefits of involving women professionals in urban development

02

Gender Lens - Energy and Green Buildings

The growing urban population contributes to an increase in energy consumption. Currently, much of the energy consumed is derived from burning fossil fuels thereby contributing to GHG emissions. This theme, therefore, focuses on projects taken up as measures to reduce energy consumption, increase energy use efficiency and transition to clean energy (renewable) with gender at its core. Women play a critical role in energy provision and consumption within households and remain under-represented both in the workforce and in decision-making positions in the sector.

01

The ‘Solar Mamma’ Programme

India, Ethiopia, Afghanistan

Scan to read more:

Why care?

Community skilling of rural women, mostly grandmothers, to become solar engineers

Placing technology in the hands of community
Source: The Hindu, October 22, 2018

Where?

Barefoot College, Tilonia, Rajasthan; Several parts of India, Ethiopia, and Afghanistan

What?

The ‘solar mamma’ programme demystifies technology and places it in the hands of the community, mostly middle-aged women, most of whom are grandmothers.

How?

The college started training young people and semi-literate and illiterate rural women to be solar engineers in the 1990s. Trainees receive instruction on the assembly, installation, operation and maintenance of solar lanterns, lamps, parabolic cookers, water heaters and other devices. The women returned to their villages with equipment to deliver sustainable electricity to their community and become role models for other women in the village.[v] Barefoot solar engineers have installed solar power plants, built parabolic solar cookers and solar water heaters as well as trained others in their communities so they could assist in the establishment of rural electronic workshops.[vi]

Gender Impact

- Fostering equal participation of middle-aged women in rural society through formal training and giving an opportunity for skilling
- Changing the ecosystem of skilling in terms of what a woman or a man should be or do, and challenging the stereotypical gender identities and relations

02

Enhancing Renewable Energy Options (EREO) Project

Sri Lanka

Scan to read more:

Why care?

Women stakeholder consultation positively impacting project design

Installation of (bio)diesel-operated water pump
Source: ENERGIA report 'Mainstreaming Gender in Energy Projects A Practical Handbook'

Where?

Sri Lanka

What?

The Enhancing Renewable Energy Options (EREO) project shows how consultations with women can inform project design that can significantly impact the daily lives of women.

How?

Mapping of women's daily schedules revealed that access to drinking water was one of the most pressing needs of the community. The village had only one unprotected well, located away from the main road. Women and children walked several kilometres several times a day to collect water from the well, facing threats of snake bites and elephant attacks. This finding was instrumental in shaping one of the project interventions, the installation of a (bio)diesel-operated water pump.

Gender Impact

> Reduced time poverty and drudgery of women and children[vii]
> Provided women with services and safety, reduced vulnerabilities
> Women became part of the decision-making

03

The 'Vidyut Sahayak' Concept (Lineswomen)

Maharashtra, India

Scan to read more:

Why care?

Women trained to become 'lineswomen' to work on electricity poles

Lineswomen
Source: openthemagzine, November 11, 2013

Where?

Maharashtra, India

What?

The lineswomen is the first attempt of its kind in the country where women were trained to become 'lineswomen'.

How?

After obtaining an electrician's diploma from either a state-run Industrial Training Institute (ITI) or a private establishment and an apprenticeship with the Maharashtra State Electricity Distribution Company, these women work hands-on with electricity poles, live cables, transformers and other pieces of field equipment that function as part of the power supply network.[viii] As part of their job, the women climb high-mast electric towers, repair insulators, report faulty electrical lines and work on routine maintenance of supply lines.

Gender Impact

> Gave women economic and social support, increasing their labour force productivity, employability and earning opportunities
> Breaking gender stereotypical definitions of professions and work profiles

03

Gender Lens - Mobility and Air Quality

Vehicles plying within cities usually contribute to a significant portion of GHG emissions and also result in deteriorating air quality. This thematic area assesses cities on the availability of public transportation and non-motorised transport infrastructure along with initiatives undertaken for transitioning to low carbon mobility. While these measures support mitigating future GHG emissions, cities also need to address the challenges of air pollution which impact vulnerable sections like women and children. Women experience urban mobility differently- their travel patterns are different, their experience of harassment and violence in public spaces and public transport is a deterrent from participation in economic activities, physical access and affordability remain neglected areas, and women remain under-represented in the sector.

01

Third Rural Infrastructure Development Project

Bangladesh

Scan to read more:

Why care?

A national infrastructure project from a gender perspective improving women's economic participation

Women planting crops in a farm in Bangladesh
Source: Asian Development Bank

Where?

Bangladesh

What?

Asian Development Bank's 'Third Rural Infrastructure Project' is a good example of how improvements and interventions in rural infrastructure, made from a gender perspective, can address women's needs and improve their participation in economic activities.

How?

The project involved the improvement of the infrastructure in small towns and rural areas, encompassing feeder roads, bridges and culverts along rural roads, flash-flood refuges, markets and ghats (boat landing facilities) and at economic centres. Simple infrastructure facilities for women like toilets, lower steps in public transport vehicles, separate market stalls, allocation of at least 15 percent of the markets' section to the construction of women's corners to promote the business of women traders went a long way towards transcending barriers that hinder women's participation in the economy.[ix]

Gender Impact

> Transcending socio-cultural barriers that limit women's economic and social participation
> Providing opportunities to women traders for business and improved their socio-economic status

02 Women Friendly City Program

South Korea

Scan to read more:

Why care?

A gender-oriented urban practice and design city programme

Increase women's safety on streets

Where?

Seoul, South Korea

What?

Seoul's Women Friendly City Program has increased women's safety by investing in transparent glass elevators, CCTV cameras, increased street lighting and blind spot mirrors installed in spaces commonly visited by women in cities.[x]

How?

The Convenient Seoul policy increased the number of toilets in female restrooms in subway stations, stadiums and parks, installed diaper changing tables and improved lighting in public restrooms, designated parking lots for women and installed more CCTV cameras.

The government lowered the height of sidewalk ledges and installed hump-type crosswalks, lowered the handles in buses and subways, promoted installation of ticket gates for baby carriages in subway stations. The Women Safety Brand Call Taxi project allowed women to access a safe taxi service at night. A phone service sends the plate number, departure time, and location via a text message to the family members of women who use the taxi at night. The city planning committee added more women as committee members for better representation.[xi]

Gender Impact

> Women's access to public spaces improved
> Gender lens brought in urban policy in practice and design

03 Training Module developed by Jagori

Delhi, India

Scan to read more:

Why care?

Gender sensitisation and training for bus drivers to tackle violence and harassment

Gender sensitisation training with DTC drivers and conductors
Source: ITDP report 'Women and Transport in Indian Cities'

Where?

Delhi, India

What?

Drivers and conductors of Delhi Transport Corporation (DTC) underwent an hour-long training module for gender sensitisation. This was a unique training method whereby drivers were made to sit in a bus and watch role-plays about how women experienced bus rides and tackled issues of sexual harassment and violence.

How?

Jagori, initiated role plays were used to initiate conversations about gender and sexual harassment. Since 2012, Manas Foundation, a mental health organisation, has taken forward this programme and have trained over 100,000 transport personnel including bus drivers and conductors, taxi drivers as well as auto-rickshaw drivers. This is in partnership with the Department of Transport which certifies the drivers with stickers after they have undergone the training.[xii]

Gender Impact

> Gender sensitisation of drivers
> Getting drivers to understand gender issues, notice unnatural behaviour, and know how to extend help to distressed women or children

04

Gender Lens - Water Management

Achieving water security will be key to the growth and sustainable development of all Indian cities and the women living in them. Climate variability and change are expected to impact water resources, especially their availability, accessibility and quality. This impacts women and girls, both directly (increase in time poverty due to the responsibility of collecting and provisioning water for their households; increased vulnerability to violence); and indirectly (increase in unpaid care work of women and girls due to health problems of family members).

01 Mini Water Distribution Project

Philippines

Scan to read more:

Why care?

Gender equity in accessing clean water, sanitation and hygiene

Photograph for representation purpose only
Source: SDG Fund

Where?

Mandaluyong City, Philippines

What?

This project is a mini water distribution system it serves its members through metered pipes and is billed as a single account with one meter for a group of 20 to 50 households, which has become a boon for the women.

How?

For women living in the squatter area of Barangay 37/38 in Mandaluyong City, taking a bath was a luxury. They had to manage with a few litres of water every day. The quality of the water was poor and it had to be boiled before use. Connections to the water supply system were not possible because the families living in Barangay 37/38, and had no land titles.

Under this project, each household is given an individual connection with its own sub-meter. Group coordinators mostly female volunteers in the squatter settlement are responsible for meter reading, billing, and fee collection for all the member households. If someone does not pay, their connection is cut off. The residents of Barangay 37/38 now have access to clean and cheaper water 24 hours a day. Operation and maintenance are managed by group leaders. Because it is in its own interest to do so, the community reports leakages and illegal connections to Manila Water. Non-revenue water has been drastically reduced.[xiii]

Gender Impact

> Women get equal access to clean water, sanitation and hygiene
> The project has greatly strengthened a sense of community responsibility for the water supply scheme and has especially benefited women from the safety angle as they have access to water at odd hours

02

Gender Mainstreaming in Community-Based Flood Risk Management

Bangladesh

Scan to read more:

Why care?

Empowering women on flooding through information dissemination at home

Photograph for representation purpose only
Source: UN Women

Where?

Bangladesh

What?

This 2004 project by the Centre for Environmental and Geographic Information Services (CEGIS) and national agencies showed how gender mainstreaming in community-based flood risk management was done through improved flood preparedness of illiterate women, which empowered them to deal with climate risks.

How?

One of the project objectives was to identify best practices regarding flood preparedness, risk reduction and information dissemination, especially to women at home. Based on the understanding that disasters are not gender neutral, the study identified and tested new forms of communicating flood information to women at home. Flood warnings were prepared using the local language and different media, including posters, flag systems, drums and broadcasts from mosques.

Gender Impact

> This enabled illiterate women to access information needed for evacuating cattle, storing crops and food supplies and organizing boats for evacuation[xiv] and made them risk-ready

Photo Credit: National Institute of Urban Affairs, Delhi

05

Gender Lens - Waste Management

Urbanisation has resulted in the tremendous increase of waste generation which directly contributes to GHG emissions. Though women are the primary waste managers at the household level, their employment in the sector is mostly confined to the lowest levels of the value chain. Further, the increased construction activity in cities result in waste that can also lead to air pollution. These aspects have a direct as well as indirect impact on women, economically, socially and environmentally.

01 All Women Recycling (AWR)

South Africa

Scan to read more:

Why care?

Creating economic opportunities and tackling climate crises through production of PET bottle boxes

Recycle of discarded plastic two litre PET bottles
Source: SEED Case Study: All Women Recycling

Where?

Southern Suburbs of Cape Town, South Africa

What?

All Women Recycling (AWR) is a small business, has created a unique product out of two litre PET bottle to address local social and environmental challenges that women face.

How?

The enterprise AWR recycles discarded plastic two litre PET bottles, which are sourced from dumpsites, community centres and schools, into greeting cards and into klikety klik boxes. The klikety klik box, a unique versatile and trendy eco-friendly gift box; is sold all around the world through agents and distributors. By recruiting and training young black women that have been unemployed for two years or more, to create these, the group not only addresses plastic waste pollution but also tackles unemployment amongst one of the most vulnerable groups of South Africa's society.[xv]

Gender Impact

> Providing increased economic opportunities for women from under represented ethnic groups
> Empowering young black women through improving their socio-economic status

City Climate Alliance :
The Way Ahead

Climate action is now, and this handbook is a humble attempt to suggest several ways and methods that could be adopted by cities for this transition.

The effort of the City Climate Alliance was based on the single thought of how we could gather, consolidate and create a more robust offering, that could provide a ready menu that could be replicated directly or through additional means of information and innovation.

The best way to approach this, it was thought, was through the doers – our partners working with and in cities, and who are part of the City Climate Alliance. We had five consultations with our partners, to explore their experience, new recommendations and suggestions for cities, in line with the climate action pathway. The discussions extended from broad issues of governance, policy reforms, data reporting and disclosure, to specific ones around monitoring and reporting systems, inter-departmental issues and the need for capacity building and need-based skilling city governments.

City managers and policymakers interested in applying for projects could take a cue from the menu of projects in the handbook and get in touch with the City Climate Alliance at the National Institute of Urban Affairs for any further information or connections to be established for further reference.

This handbook also serves as a project repository for climate action that could be used by government departments, think-tanks, academic institutions, partner agencies and cities for getting a ready-to-consume and filtered information on the huge body of work that is taking place in India, which is slowly but surely racing towards achieving the Net Zero dream.

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Want to Collaborate with City Climate Alliance?

Reach out to us at cityclimatealliance@niua.org

We sit within NIUA as a cross sectoral umbrella bringing all ideas, systems, projects, and institutions together for climate action in cities.


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